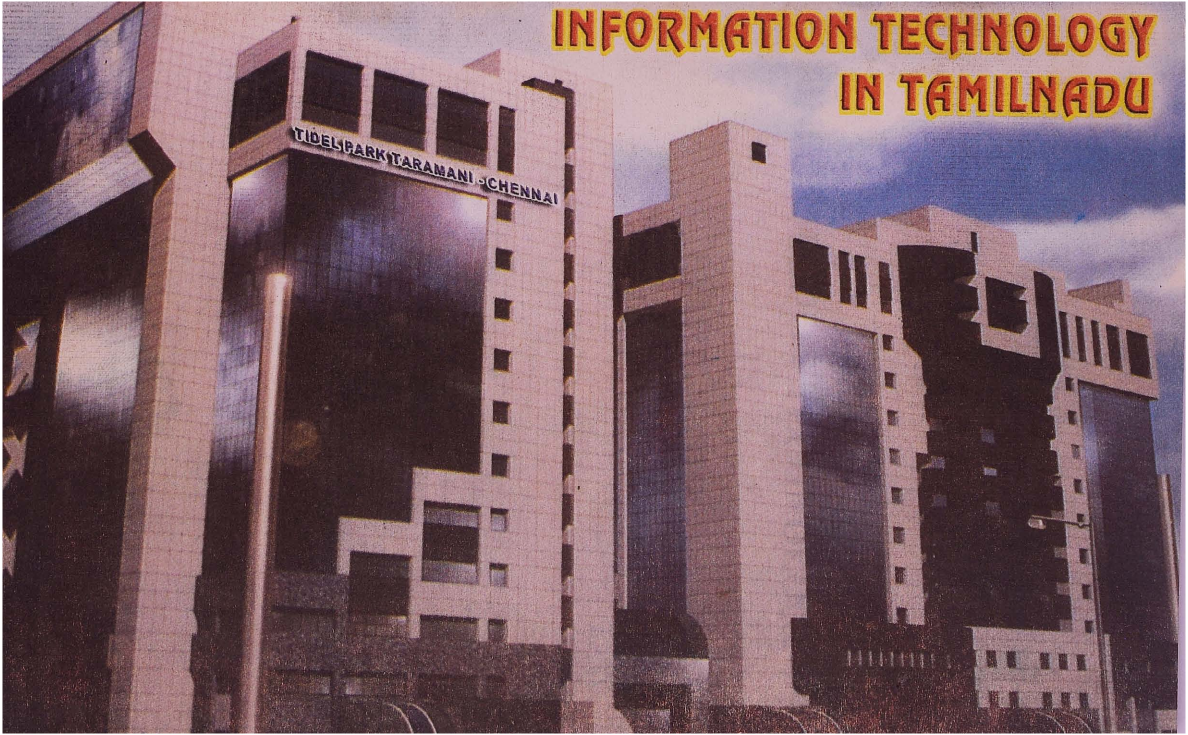
# INFORMATION TECHNOLOGY IN TAMILNADU



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# IN
# TAMIL NADU

*Papers Published in October 1999 by*
**Harvard Institute for International Development**
**HARVARD UNIVERSITY**

*Published by*

Secretary to Government,
Department of Information Technology,
Government of Tamil Nadu.

# Information Technology in Tamil Nadu

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**M. KARUNANIDHI**
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# FOREWORD

Tamil Nadu is firmly established as a major player in India in "Information Technology". Our software exports have grown from just about Rs.37 crores in 1995-96 to nearly Rs.1890 crores in 1999-2000. During this period, the number of software units has also grown from just 34 to 596.

This is because Tamil Nadu provides the ideal environment for the growth of the IT industry. Tamil Nadu has excellent physical and social infrastructure. Its human resources are the best in the country. All these inputs are available at very reasonable cost. Our commitment to good governance creates the supporting environment required for these inputs to work harmoniously for the rapid socio-economic growth of the State.

The Harvard Institute of International Development, a specialist organisation of the internationally reputed Harvard University, USA, had studied the growth of Information Technology in Tamil Nadu. Based on their studies, they have published two papers in October 1999, namely:

i. **Information Technology - Led Growth Policies. A Case Study of Tamil Nadu.**

ii. **Raising the global competitiveness of Tamil Nadu's Information Technology Industry.**

These Papers have analysed in detail the success of Tamil Nadu in Information Technology in the context of our pro-active, growth oriented socio-economic policies and we commend the effort of Harvard University.

As they offer valuable insights for policy makers concerned with these issues, the Government of Tamil Nadu have decided to make these Papers widely available.

M. Karunanidhi.

**(M. KARUNANIDHI)**

## PART - I

# INFORMATION TECHNOLOGY-LED GROWTH POLICIES: A CASE STUDY OF TAMIL NADU

■ *Nirupam Bajpai and Anupama Dokeniya*

*Abstract*

*The Tamil Nadu Government has expressed an intent and developed a policy framework to accord primacy to an informatics-led growth strategy in accordance with global trends in this area. The policy covers various aspects of information-led growth - creating a robust domestic IT industry- ranging from the application of information technology to various aspects of life, to the growth of services, and increasingly, the development of a robust information infrastructure backbone on which information goods and services will ride. This paper discusses the information technology policy of the Tamil Nadu Government assessing these various aspects, and the potential linkages between them.*

*There are some crucial inputs into an information infrastructure initiative: (1) research and training institutions; (2) a local labour market with quality engineers and technicians; (3) favourable tax and credit incentives; (4) bureaucratic flexibility and efficiency, institutional support; and (5) supporting infrastructure: a good transportation system, adequate telecommunications.*

*On the demand side are the applications that need to be encouraged for efficiency gains; for diffusing the benefits of the information revolution through increased citizen participation; and for creating demand as a spur to the information technology industry itself. The impact of a robust IT industry on development of the regional/local economy as a whole will depend on various factors: increased employment-generation; efficiency gains from the application of information technology; and foreign capital inflow, resulting both from the foreign investment in the local IT*

*industry and export earnings gained by progressively capturing higher value-added segments of the global IT market.*

*The paper argues that the extent to which the benefits of the 'information revolution' are actualized and the potential of IT is harnessed will depend on the success with which countries (and regional sub-divisions) are able to understand and incorporate into policy and initiatives these inter-linkages between various components of an IT strategy, as well as the specific impact of IT on economic growth and development. The Tamil Nadu Government's IT strategy, although progressive and comprehensive, is deficient in its understanding of these inter-linkages, and needs to address them to ensure that a flourishing IT industry translates into regional development.*


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# INFORMATION TECHNOLOGY-LED GROWTH POLICIES: A CASE STUDY OF TAMIL NADU

■ *Nirupam Bajpai and Anupama Dokeniya*

Pronouncements by most states in India of an 'information society policy', are responses to a growing global discourse on the primacy of an 'information infrastructure' to all future economic activity and growth strategies. Information society policies cover a variety of phenomena - ranging from the application of information technology to various aspects of life, to the growth of services, and increasingly, the development of a robust information infrastructure backbone on which information goods and services will ride. The phrase 'information infrastructure' particularly, assumes the significance of the convergence of information and communication technologies, and draws attention to the importance of creating an adequate telecom backbone capacity to enable the establishment of an information economy. Tamil Nadu's efforts in this direction have been slightly more modest, given its status as a regional state, with limited jurisdiction over telecom infrastructure issues.

Nevertheless, in 1997 Information Technology (as opposed to information infrastructure) Policy (see Appendix 2) encompasses the various facets of establishing an information society. It states that the main objectives of the policy are:

★ To encourage and accelerate the growth of hardware and software industries and associated services in the State and to remove the bottlenecks for starting and running of such units in Tamil Nadu.

★ To increase both domestic and export earnings of software and hardware sectors in the state.

★ To upgrade and develop manpower skills required for the I.T. industry by facilitating training, to accelerate the use of I.T. in schools, colleges and educational institutions with a view of

providing skills and knowledge to the youth to make them fit for employment in this sector.

★ To upgrade the quality of life of the citizens of the state by facilitating access to consumer application of information technology.

★ The Government will also encourage use of I.T. in Government institutions and Departments with a view to improving productivity and efficiency of Government services, revenues and tax collections, and assist in the process of decision-making by Government, and monitoring of Government programs[1].

These aspects are not necessarily related in that the presence of an information technology industry might not assure IT-led growth for the entire economy. This will be based more importantly on the success with which IT is applied for economic growth and productivity generally[2]. The application of information and communications technology to the Government and industry is a demand-side issue, while establishing a local information technology industry, through both domestic and international investment as well as the provision of a telecommunications infrastructure are essentially supply-side issues. Both conceptually, and in practical terms of policy-making and Government initiatives, these aspects need to be distinguished, and the inter-linkages between them need to be explored. This paper will discuss the information technology policy of the Tamil Nadu Government assessing these various aspects, and the potential linkages between them. Most of the discussion is based on field research conducted

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[1] *Government of Tamil Nadu, Information Technology Policy, 1997*
*What is markedly absent from these objectives is the emphasis on a communications infrastructure, which we have discussed as one of the important aspects of an information society. This is indicative of the limited role of the State Government in the IT sector, as will be discussed below.*

[2] *This point was made markedly by Gopal Srinivasan, CEO of TVS Electronics in an interview. He pointed out that while Bangalore had developed a flourishing information technology industry, Karnataka State is relatively poor in the diffusion and application of information technology.*

in Chennai in May 1999, comprising of extensive interviews with both Government and industry officials (see Appendix1). This is supplemented with data from official publications and information posted on the Internet (see Appendix 3 for list of web-sites on Tamil Nadu economy).

The paper will focus specifically on strategies of developing a local information technology industry. One of the main pillars of informatization has been the emphasis on attracting global IT hardware and software firms to locate to the local area as a spur to the entire local/regional economy. While this constitutes part of the information society discourse, high technology-led growth strategies certainly pre-date the contemporary emphasis on information infrastructure and have been an important part of growth strategies, especially in the East Asian newly-industrializing countries (Evans, 1995; Carnoy et al, 1993; Castells, 1989; Castells and Hall, 1994). Regional development theorists have pointed to the significance of high-technology zones as contributing to general economic welfare, through the diffusion of economic benefits. To institute high technology-led growth, regional states have to gain competitive advantage to both attract private investment, and make their industries more competitive. The location of these specialized areas are seen as having potential for regional development through spin-off effects in the areas of employment - especially highly-skilled, and hence highly-paid - employment, capital inflow, diffusion of technological know-how etc. Such zones are seen as having the potential to capture the high value-added segments of the global market, if the availability of highly-skilled (and low cost) labour, and technological facilities, enable situating advanced services in these zones.

However, this paper argues that the extent to which these benefits are actualized and the potential of IT is harnessed will depend on the success with which countries (and regional sub-divisions) are able to understand and incorporate into policy and initiatives these inter-linkages. As a framework for reference, Figure 1 shows the linkages between the various aspects of an IT policy. The input

box identifies the crucial inputs without which an information infrastructure (II) policy is unlikely to be successful.

There are some crucial inputs into an information infrastructure initiative:

★ research and training institutions; a local labour market with quality engineers and technicians.

★ favourable tax and credit incentives.

★ bureaucratic flexibility and efficiency, institutional support.

★ supporting infrastructure: a good transportation system; adequate telecommunications.

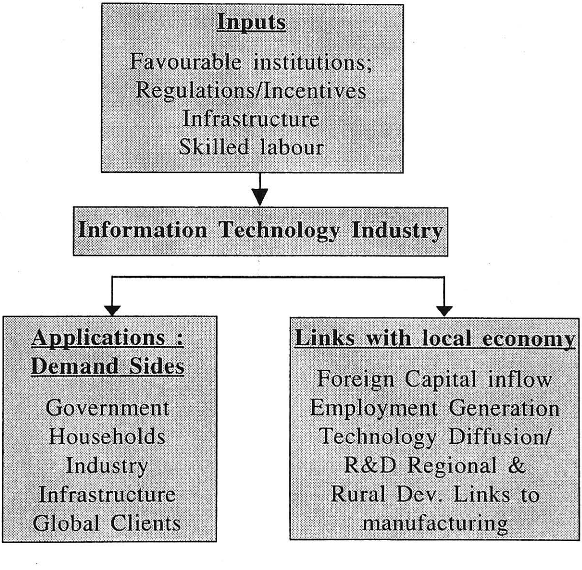
Low cost, skilled labour is undoubtedly crucial and India's comparative advantage in software has been premised on a well-developed educational infrastructure. However, in a situation where countries are becoming increasingly competitive in attracting international investment, the existence of a favourable institutional climate -- comprising of, among other things, investor-friendly Government institutions, market-friendly incentives, a rationalized tax structure, subsidies where necessary, and clear non-restrictive regulations - that invokes investor confidence is instrumental to an outward-looking strategy. The third crucial input is the availability of necessary infrastructure - in the case of information technology, this of course being a telecommunications infrastructure. The importance for upgrading the latter has become increasingly more pressing as the shift to information based goods and services requires increased bandwidth.

The applications side refers to the users of the information products and services. In order to reap the advantages of informatization, the applications need to be encouraged for efficiency gains; for diffusing the benefits of the information revolution through increased citizen participation; and for creating demand as a spur to the information technology industry itself. Concerted efforts to create demand through applications in Government, infrastructure sectors, households and domestic

industry need to be made. The last box shows the potential ways in which the development of an information technology industry results in development of the regional/local economy as a whole: through increased employment-generation; through efficiency gains from the application of information technology; and through foreign capital inflow, resulting both from the foreign investment in the local IT industry and through export earnings gained by progressively capturing higher value-added segments of the global IT market.

The following sections will deal with each of these aspects. Section-1 discusses the essential inputs into a successful IT strategy, analyzing both the strengths and weaknesses of Tamil Nadu along the dimensions mentioned. Section 2 discusses the linkages of an IT strategy to general economic development, and applications of IT for development.

**Figure 1: IT and the Regional Economy**



## SECTION 1: CRUCIAL INPUTS INTO IT STRATEGY

### 1.1 Institutional Environment

The State Government policy on IT points to the importance of the IT sector for the economic development of the state. Re-iterating the thrust on IT in the state's growth strategies, the Governor, Fathima Beevi announced in her address to the state Assembly that the Government "has decided to accord high priority for Information Technology due to its potential for accelerating the economic growth of the state, providing increased employment opportunities, and enhancing the efficiency of Government agencies and the quality of their service to the people[3]."

Government documents point out that the emphasis in the years to come will be in:

★ create infrastructure for software development at Chennai, Coimbatore, Madurai and Trichy.

★ encourage Tamil Nadu companies to globalize their operations to meet the demands of economy.

★ encourage global companies to relocate their operations in Tamil Nadu and to start their new manufacturing divisions in Tamil Nadu.

★ encourage joint venture initiatives in leading edge technologies.

★ reversal of brain drain.

Undoubtedly, the first step in a successful IT strategy is the creation of an institutional infrastructure that supports the establishment of an IT industry. In the more industrialized countries,

[3] *Speech of the Governor, Fathima Beevi*

technology parks have arisen spontaneously with the convergence of a number of factors. The newly-industrializing countries (NICs), South Korea, Singapore, Hong Kong[4] and Taiwan, along with their economically stronger neighbour, Japan, are often presented as successful developmental states, and examples for the less industrialized countries (Amsden, 1989; Deyo, 1987; Evans, 1995). Their success is often attributed to a proactive developmental state, willing and able to increase the competitiveness of indigenous companies in the world economy by providing necessary support in the form of industrial and communications infrastructure, labour training, credit, trade policies, and science and technology.

In Japan, for instance, the Ministry of International Trade and Industry (MIIT) undertook the mandate to chart a long-term technological development future, to jump start it by public investment in basic research and development, and to promote and coordinate the resulting commercial exploitation through vigorous competition within the private sector. Korea's Ministry of Science and Technology is following the same model (Evans, 1995; Castells and Hall, 1994).

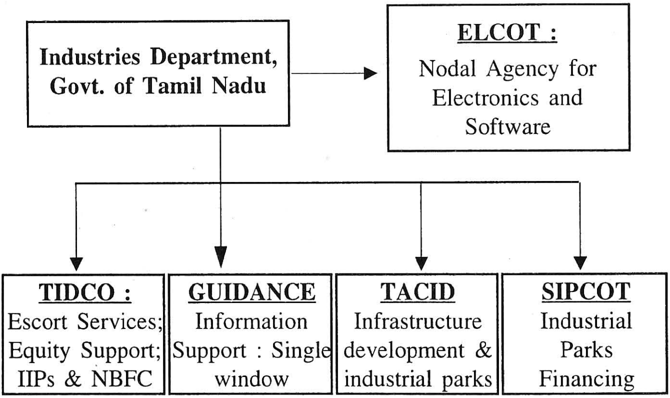
The Tamil Nadu Government has taken steps in this direction by establishing a Department of Information Technology, which was separated from the Ministry of Industry in 1997, into a separate department. The bureaucrats, in charge are very pro-active, and industry-friendly. It has also set up an Information Technology Task Force, with members from both the Government and private industry.

Tamil Nadu has also established a set of very progressive and forward-looking institutions - ELCOT (Electronics Corporation of Tamil Nadu); GUIDANCE (Tamil Nadu Industrial Guidance & Export Promotion Bureau) ; TACID (Tamil Nadu Corporation for Industrial Infrastructure Development Limited), SIPCOT (State

[4] *although other East Asian Countries, notably Malaysia, can rightfully make claim to this label too.*

Industries Promotion Corporation of Tamil Nadu Limited), SIDCO, TIDCO (Tamil Nadu Industrial Development Corporation Ltd) -- all of which provide institutional and infrastructure support to various industries that the state Government seeks to invite or foster in the state.

**Figure 2 : Institutional Environment**




The state Government has provided a variety of incentives to the IT industry to locate in the state :

- ★ no entry or purchase tax in Tamil Nadu
- ★ uninterrupted power facility
- ★ IT parks eligible for incentives and concessions on par with other industries.
- ★ Private IT park developers to be assisted with land acquisition and re-zoning.

★ co-ordination with VSNL/DOT to provide and expand dedicated connectivity/Earth station.

★ private IT parks will have the same status as IT parks developed by Government agencies subject to certain quality standards and location for eligibility for concessions and incentives.

★ Incentives to units in the ITP/STPs will be extended to stand-alone units outside the park also.

★ All software industries including services and training institutions will be entitled to all concessions and incentives applicable to industries.

★ exemption from stamp duty and registration charges at the time of allotment of sites/built up space, and exemption of works contracts tax.

★ single window clearance for units within the parks.

★ Software units will be excluded from purview of Tamil Nadu Pollution Control Act.

One of the main problems has been the diffusion of IT awareness to different levels of the bureaucracy, which makes streamlining bureaucratic procedures particularly difficult. While the top bureaucracy in the state has been very dynamic in pursuit of an industry-friendly environment and in its efforts to launch an information society in the state, such dynamism is slow to diffuse to other levels of the administration[5], and to other sectors, not directly concerned with IT. The NICs have created clusters of institutions to improve the ability of small and medium-size enterprises to absorb and implement the new technologies. Such

[5] *Interviews with top Government officials in the Industry and IT departments, ELCOT, TIDCO, TACID and GUIDANCE.*

projects have allowed some east Asian cities to become "information nodes', providing connection and networking for cities throughout the region, and leading to rapid economic development.

The emphasis on infrastructure development in the IT parks has the potential to result in inadequate emphasis on creating an institutional environment that is favourable to the IT industry as a whole rather than the ones that are located in these parks. In theory, the Government does state its intention to provide incentives to all IT firms: "Apart from development of software and hardware Industry through ITPs / STPs the Government will also encourage software development outside the Parks by giving such stand-alone units the same incentives as the Units in the ITPs / STPs. There will be no location restrictions for setting up units exclusively engaged in software development/ training."[6] However, one of the major deficiencies of the IT policy that emerged from interviews with software company officials was that, companies that locate outside the technology parks would still have to approach the various agencies separately to get the necessary clearances. Single-window clearance doesn't necessarily operationalize in practice and still involves running to different agencies to get access to different facilities - for instance, getting land allotted to set up a company, when it is not located in the software park.

## 1.2 Infrastructure

Both social and cultural infrastructure is important for the development of a robust IT industry, both to enable firms to achieve operational efficiencies, and to attract a high-quality human resource base, an indispensable input into the IT industry. Physical infrastructure includes telecommunications, good roads and transport, and power supply. The social-cultural infrastructure would include a good educational system, a cosmopolitan

[6] *Government of Tamil Nadu, Information Technology Policy, 1997*

entertainment facilities etc. While Tamil Nadu does have a good educational system, it is markedly deficient in a creating a cosmopolitan environment that would attract global professionals.

A recent NASSCOMM study rated Tamil Nadu the best location for setting up a software industry. On a scale of 0-3.5, it rated Tamil Nadu very high among a set of indicators, as the following table shows.

**Table 1 : Ranking of Tamil Nadu as Location for Software Industry**

| Infrastructure & Amenities | Nasscom Ranking | BT - Gallup Rank in India |
|---|---|---|
| Availability of Software Manpower | 3.5 | NA |
| Data-Communications Facility | 3.0 | NA |
| Power Supply | 2.8 | Third |
| Education Facility | 3.0 | NA |
| Airports | 3.4 | Second |
| Transportation | 3.0 | Second |
| Cost of Living | 2.8 | NA |
| Cost of setting up of Software Unit | 2.95 | NA |
| Quality of Life/Social Infrastructure | 3.0 | Second |
| Climate | 2.5 | NA |
| Proximity to Market | 3.3 | Third |
| Overall Rating of City | 3.2 | NA |

Sources : NASSCOMM Study; Ministry of Industry Presentation.

The Tamil Nadu Government has instituted a relatively ambitious projects for the development of the IT sector. Four major IT park initiatives are in the works, equipped with State-of-the-art infrastructure, provided by the Government.

**Table 2 : Main IT Park Infrastructure Development Projects**

| Name of IT Park | Implementing Agency | Total Investment | Current Status of Development | Main Facilities |
|---|---|---|---|---|
| Siruseri IT Park (near Chennai) | SIPCOT | NA | NA | 200 acres |
| TIDEL Software Park, Taramani (in Chennai) | TIDCO-ELCOT | NA | NA | 8 acres |
| Texcity-Technology Park at Coimbatore | Private initiative ELCOT | NA | At initial stages | 10,000 sq. meters |
| Sholinganallur Software Technology Park | ELCOT | | Being set-up; Facing legal problems in land acquisition | NA |

*Sources* : Various Government documents.

While the NASSCOMM study rates Tamil Nadu quite high in terms of physical infrastructure, many problems remain in this area.

## Power Supply

While the Government has promised uninterrupted power supply to the IT industry, power-supply continues to be a major problem faced by software firms[7]. According to the 1998 Global Competitiveness Report, the quality of infrastructure in India is judged to be very poor. This was true in all areas: roads, ports, power, and telecom. India was ranked 53rd out of 53 countries in overall infrastructure. While Tamil Nadu rates better than other Indian states, the state is required to upgrade the quality of its existing infrastructure and add to the existing capacity in order to attain and sustain higher levels of SDP growth.

In the area of power, for example, the reform of the state electricity board (SEB) is critical if uninterrupted power supply is to be assured to investors. This would imply rationalization of the tariff structure, (the present structure of tariffs in electricity, involving extensive cross subsidization for agriculture, has imposed disproportionate burden on paying customers. This has led to decline in consumption of power by high-tension users, with serious financial consequences for the SEBs), reduction in the transmission and distribution (T&D) losses, and reform in the generation and distribution of power.

There are severe organizational deficiencies in SEBs. Some of these are: absence of a well thought human resource development policy; lack of incentives for performance; poor or no review of functions; lack of inventory control and cost management, and absence of MIS - use of outdated information for decision making.

The context in which SEBs function is wholly dysfunctional for high performance, and results are affected a number of factors, such as extreme politicization in staff matters; interference in contracts and purchases; influencing the drawing of new lines,

[7] *Officials of the local IT industry have formed an association to represent these problems to the Government, and to make a concerted and coordinated effort to find solutions to these problems.*

location of substations, and superceding the judgements of technocrats.

Plant load factors (PLFs) have been historically low - worse in the SEB generators than in those of the National Thermal Power Corporation (NTPC) - and T&D losses largely due to pilferage are very high. Increasing efficiency in these two areas can itself lead to a vast improvement over the present situation. Of course, given the impact of the SEB losses on the state budgets year after year and the worsening state of State finances, reform of the tariff regime and privatization of the generation and distribution networks cannot be postponed for long.

**Transport**

Many industry officials complained that it was difficult to get access to facilities located on the outskirts of the city, and employees were loath to commute to these locations in the absence of good transport facilities. Reform in the area of urban transport is crucial if the State Government is to achieve success in attracting companies to locate in Tamil Nadu. Since firms look to the outskirts of major cities, such as Chennai to set-up their offices, the availability of efficient transportation is necessary. Commuting in the buses of the state-run State Transport Corporation is difficult, even though cheap since these are subsidized heavily. Bus tariffs should be rationalized so as to cover the costs of running these bus lines and improving their services. Of course, private bus operators can be introduced in specific routes to cater to the demands of the firms locating in the suburban areas. In the next few years, as in the case of the power sector, in the urban transport sector too the State Government has to privatize these infrastructure services so as to keep up with the rising demands of a fast growing state economy.

**Telecommunications**

The availability of a robust telecommunications infrastructure is crucial in investor decisions to channel capital into a particular

region. As the National Taskforce on Information Technology, points out: "International experience has shown that hi-tech industries flourish essentially in the rural hinterland adjacent to cities with modern telecom and communication infrastructure and top class hi-tech educational/research institutions." Undoubtedly the biggest stumbling block in the development of a successful information infrastructure policy is the limitation of the telecommunications backbone and the inability of the state Government to take very many initiatives in this area given that the Central Government has jurisdiction over this.

The problems of a telecom infrastructure have affected different sectors of the state: the software sector for instance, needs high bandwidth dedicated lines, with constant customer support. VSNL, the international telecom monopoly, provides 24 hours a day, seven days a week customer service support. The problem arises at the level of the local lead line - software companies complain that often the local loop goes down resulting in the inability to uplink data streams. This has been one of the major problems faced by the local software companies. The Tamil Nadu Government has already taken significant measures in this direction, the WorldTel project being the primary among them.

The '97 IT policy states the Government's intention to address this problem: "The Government will provide assistance to VSNL and Department of Telecommunications to expand communication links in the State and also provide the land and power wherever required by such agencies. State Government will liaise with Government of India to ensure dedicated VSNL connectivity / Earth Stations as well as Electronic Telecom facility for each ITP"[8]. However, the Tamil Nadu circle has been disadvantaged by the absence of the autonomous status that the MTAMIL NADUL has enjoyed in Mumbai and Delhi. Till the policy is changed at the

[8] *Government of Tamil Nadu, Information Technology Policy, 1997*

Central level, the state Government's ability to develop the sector is restricted to make representations/ lobby at the Central level.

Political considerations are very important in determining the success of these lobbying efforts. The Tamil Nadu Government's efforts have been restricted by the absence of a stake in the central Government. The delays in the implementation of the National Telecom Policy at the Center, made representations of the state Government to upgrade the telecom service unsuccessful. Moreover, there is no coordination mechanism between the state Government and the DOT at the state levels. The state Government officials, for instance, voiced concern over the lack of information about the expansion plans of the state level DOT.

## 1.3 Technical Education

Training the labour force in the use/application of information technology has the possibility of giving the state cost and competitive advantage for the location of other industries. While many states in India are initiating information infrastructure policies, what makes Tamil Nadu's efforts in this direction more credible - and attractive to potential investors - is the large pool of highly-skilled labour that provides a ready input into the IT sector.

The 1997 IT policy has provided for the diffusion of IT know-how throughout the state. It states: "Basic training in computers will be introduced in all schools from the high school level. The endeavour will be to cover all schools within a 5-year period. Training of teachers will also be done in a phased manner over the 5-year period. In addition to Government sponsored training programs, State Government will facilitate and co-ordinate with other sponsors like INTEL, IBM, APPLE, etc., for training of teachers.[9]

[9] *Government of Tamil Nadu, Information Technology Policy, 1997*

The Tamil Nadu Government has also taken strong initiatives to develop the technical educational base in the state. The most recent initiative in this area has been the setting up of the Tamil Nadu Institute for Information Technology (TANITEC). Tanitec has drawn up a three-pronged strategy to make Tamil Nadu an 'intelligent state' where information technology will be utilized in all aspects of life. The strategy comprises education; research and development; and upgrading of infrastructure of educational institutions by networking the whole state by VSAT. Tanitec is proposed to have strong linkages with industry in the form of participation of industry executives in the faculty of the institute and participation of students in industry.

## SECTION 2 : LINKAGES TO GENERAL ECONOMIC DEVELOPMENT

The information technology revolution is touted as leading to many benefits and possibilities for economic growth. One of the main aspects of this correlation that has been studied is the impact of 'informatization' on economic performance. Typically, this refers to the benefits accruing as a result of deployment of information technology in various manufacturing, managerial, coordination activities, and the provision of services.

It is important to make the distinction between the deployment of information technology - computerization - on economic performance and the impact of the location of an IT industry economic development. As discussed with reference to Figure 1, the relationship of IT to economic development takes into account, some key aspects.

- ★ Foreign capital inflow
- ★ impact on employment
- ★ Technological diffusion and local R&D, enabling capturing a higher value-added segment of the global market.

★ Regional and rural development

★ links to manufacturing.

★ Applications

## 2.1 Foreign Capital Inflow :

The software industry in Tamil Nadu has been performing extremely well, growing at a rate higher than its competing neighbours, Andhra Pradesh and Karnataka. According to STPI, software exports from the state have grown from Rs. 400 crores in '97-'98 to Rs. 1246 crores in '98-'99[10]. The number of software companies has grown from 108 to 153. Offshore software development has grown to Rs. 896 crores from about Rs. 200 crores. 76% of the software exports are to the US. About 37 companies have exported software worth more than Rs. 1 crore each. The software export turnover from Tamil Nadu has increased from Rs. 2.35 crores in 1993-94 to Rs. 12.46.14 crores in 1998-99. Of this, STPI units accounted for Rs. 776.14 crores, and non-STPI units accounted for Rs. 470 crores. In 1998-99, total offshore export earnings amounted to Rs. 896.14 crores, while on-site amounted to Rs. 350 crores. The projected revenue for Tamil Nadu according to the Ninth Five-year Plan for 2001-2002 is 13,000 crores (Rs. 5000 crores in hardware and Rs. 8000 crores in software).

## 2.2 Employment

While critics argue that new information technologies are more likely to lead to job loss because of laboursaving automation, and rationalization of economic activities, computers have employment-creating potential. Moreover, the employment that it creates is of a more highly skilled variety, implying that more highly paid labour force that would entitle them to a better quality of life. Of course,

[10] *Crore = 10 Million*

this comes back to the question of investing in education. The employment benefits of the IT industry in Chennai would be significant since Tamil Nadu has a very strong technical education base.

Moreover, the information age would likely radically alter the structure of the work force essentially disrupting traditional divisions of labour, and creating new ones. It seems likely to create two-tiered workforces - upper level of knowledge workers, analysts, and a lower level of typists, data processors, and enablers. The resulting division promises to flatten previous work hierarchies and create new management challenges. Aside from simple computer literacy, those developed country cities with high numbers of critical thinkers capable of turning raw data into marketable information will thrive. Since lower-skilled labour is more susceptible to automation, one of the biggest challenges of informatization, is to re-train workers in new skills. In the NICs, Governments have proved crucial in coordinating investments and programs in telecommunications, education and training, and in diffusing information services and software applications.

## 2.3 R&D, Entrepreneurship, and the Innovative Milieu

In their pursuit of technology-led growth, countries have adopted a variety of strategies (Castells and Hall, 1994; Dubard, 1995, Zeigler, 1995):

- ★ Industrial complexes of high technology firms that are based on an innovative milieu, linking R&D and manufacturing

- ★ Science-cities, which are essentially scientific research complexes.

- ★ Technopoles that aim to induce new industrial growth, in terms of jobs and production, by attracting high-technology manufacturing firms to a privileged space - these are mainly

defined in terms of economic development. This is a deliberately established high-technology business area, resulting from Government or university-related initiatives.

★ *Teleports* : To maintain and support information-based industries, larger cities in more developed nations have created teleports, concentrating information technology resources such as communications equipment linked to satellites. Users either locate adjacent to the teleport, or access it through communication lines. Teleports exist in London, Rotterdam, New York City, and Osaka and are often joint ventures between public and private concerns. Germany has a national chain of some 30 teleports, and the concept is spreading across Europe.

* *Specialized Telecommunications Networks:* Edinburgh, Scotland, and San Antonio, Texas, have each separately worked with local telecommunications companies to develop specific packages to attract businesses.

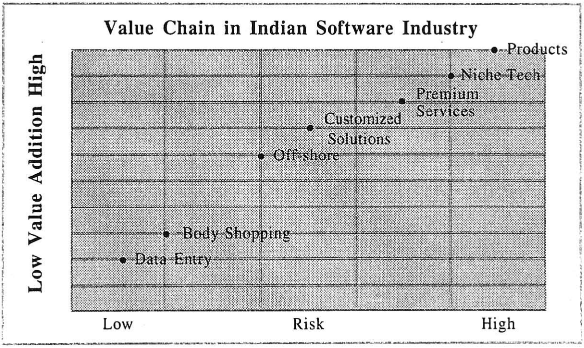
* *Targeted Development* : Singapore is the most prominent example. This city-state seized upon its strategic location to develop as an information transportation hub and used technology to spring its economy. Some 3,000 companies have been attracted to Singapore, which has been so successful that it now directs some low-skill jobs away from its workers and toward other area countries. Still, Singapore has attributes that make such success difficult to transfer- primarily an extremely strong central Government with the ability to if the user' doesn't need the information on his or her computer.

Castells and Hall point out that economic theory suggests that early-developing countries will need to concentrate on importing existing technologies. At the next level of development, they would need to encourage inward investment via transnational corporations. Since they compete with other countries for this pool of investment, they need to provide incentives (as discussed above to international

capital). At a higher developmental level, they would aim to develop sufficient technological capacity to improve on existing technology, by a combination of downstream product innovation and process innovation. In terms of the national economy, the advanced technology industries can be exported from leading to lagging regions, while the leading regions -- and therefore the economy as a whole - are moving into the field of indigenous innovative capacity.

As Langdale (1997) points out, Northeast Asian economies (Japan, South Korea and Taiwan) with large export-oriented information equipment industries are rapidly developing broadband and multimedia industries because it would be very difficult for their firms to be internationally competitive without having an innovative domestic market. A second group are regionally oriented economies (Singapore and Hong Kong) that have focused on their regional headquarters' role for major foreign (mainly US) multimedia companies. The third group ranges from the near newly industrializing countries (NIEs), such as Thailand and Malaysia, to poorer countries such as China. In general, the tele-density in these countries is very low, and most of these countries are primarily concerned with expanding basic telephony services, particularly in rural areas.

**Figure 3: Value-added Chain in Indian Software Industry**




*Source :* Bajpai & Shastri, 1998

A robust IT industry might be created by attracting foreign investment to take advantage of low-cost technically-competent labour, for various low-end activities such as data-processing, data-entry etc. Eventually in order to make the benefits from high technology growth sustainable, emphasis will have to be placed on well-educated labour and applied research in specific fields. Investing in and encouraging basic research is crucial. In the long run, innovation will come through investment in and promotion of innovation centers, and enable the country (or region) to progressively harness a higher value-added segment of the world market.

The establishment of a research university would be important at this stage. Developing centers of excellence for both basic and applied research is thus key to technology-driven growth. Investing in R&D, with the strategy of promoting later innovations has to be an ongoing activity. Just as Stanford University was key to the development of Silicon Valley and MIT was key to the development of the Boston Corridor, significant synergies with university research has to be inculcated. Chennai, of course, has a natural advantage in the location of the Indian Institute of Technology.

In Taiwan, the Government set up the Hsinchu Park that was based on a deliberate cooperation between the Government, university and the industry. A major reason for the development of the technology park in Hsinchu was the presence here of the Industrial Technology Research Institute (ITRI), a major technology transfer institution. One of ITRI's six research organizations, the Electronics Research and Service Organization (ERSO), was used deliberately by the Government to diffuse microelectronic technology among Taiwanese firms, by organizing seminars and training programs where Eros's technology was communicated to private firms. To ensure linkages between ERSO and private firms, the Government funds only 50% of the Institute's budget. The other half comes from service contracts and technology sales to firms. Firms located in the Hsinchu park also enjoy a five-year tax

holiday, a maximum income tax rate of 22%, duty-free imports of machinery, equipment, raw material and semi-finished products, and capitalization of investors' patents and know-how as equity shares, tax breaks and low interest loans.

The other important components in making the advantages of IT-led growth sustainable are to inculcate the development of a local entrepreneurial base. A local entrepreneurial base would not only decrease dependence on foreign sources of investment, but also result in an innovative milieu that would enable the local industry to situate itself at a higher value-added segment of the market. Tamil Nadu does have the genesis of a strong local entrepreneurial base with companies such as Pentafour, Future Software, Polaris Software, which are home-grown companies that have expanded globally, in addition to more established firms such as TCS and HP.

## 2.4 Regional and Rural Development

The danger of high technology-led growth is that it might result in over-emphasis on certain - usually urban areas and regions - to the absence of a more balanced, and equitable regional development. The weak link in the Hsinchu Park has been its failure to make linkages between the Technology Park and the surrounding areas. As Castells and Hall (1994) point out, the town of Hsinchu continues to be more of a satellite town of Taipei. The IT parks in Tamil Nadu are similarly satellite towns of Chennai. Culturally, administratively, they are likely to continue to be linked with Chennai, where most of the educated labour force would want to be located, as well as where most companies would want to locate their operations.

Madon points out that contrary to the international reputation earned by Bangalore, the advent of the information age has not affected the overall economic picture of the state, which remains primarily an agricultural state. Out of the total population of almost

50 million people, around 76% live in rural areas, and there is a high incidence of rural poverty in these areas. Foreign high-technology companies are largely responsible for the rampant wage inflation in Bangalore.

Japan's technophiles program was intended to reduce geographical imbalance, and bring about regional development. It viewed the 'technophiles' as a technology-intensive city that effectively combines an industrial sector composed of electronics, machinery and other most advanced technologies with an academic and a residential sector. The program was intended to also develop a local R&D capacity to help trigger the development of such industries locally, and the relocation of high-technology industry from the congested metropolitan areas to the hinterland -- the more backward regions.

MITI intended to create incentive for local initiatives - the technology parks would be located in regions where the local Government provided the most attractive conditions. Hence, the local Government was intended to play a crucial role in attracting the prefectures. MITI's technophiles program has had only moderate success. The strategy of developing R&D through diffusion to the local areas has not been successful, in that most of the firms located in the regional prefectures ended up being branch plants. This demonstrates essentially a tension between the two objectives of situating industries in geographically backward areas, and establishing an innovative R&D base.

## 2.5 Applications

While the high technology sector might itself make a small contribution to total output, and on its own has limited impact on productivity and competitiveness and standards of living, its real impact stems from the capacity to deploy technical capabilities across all economic and industrial activities. An OECD discussion (OECD, 1989; OECD, 1992) of IT and economic growth suggests

that future growth areas triggered by broader IT production and use will be nurtured from:

★ Intermediate and final demand of industry: Since, IT-induced change will proceed by the use of IT products in other industries. The engineering industry - covering mechanical, electrical, and electronic and instrument engineering, transport equipment and miscellaneous mechanical goods and precision instruments - will be a major recipient of compensation effects that arise in capital goods production as the new technology is used more extensively. The state has to make concerted efforts to encourage the adoption of IT in industry, both to increase operational efficiency of local businesses, and to create an indigenous market for IT products.

★ Government purchases: The deployment of information and communications services for increasing efficiency in governance - what has become known by the buzzword "e-governance" - (a) to increase the interface between the public and Government; (b) for service delivery (c) to increase efficiency in governance etc. The deployment of IT in governance has been the most difficult part of the IT initiatives. Many impediments arise in the deployment of IT in governance. The introduction of IT is disempowering to mid- level officials. Secondly, one of the most important problems in the implementation of IT in Government, is what the IT secretary, D. Prakash, refers to as 'ownership' of the IT solution[11]. By this he means that the impetus to implement the IT infrastructure, to identify the problems that require an IT solution, to sustain the implementation etc. should come from within the concerned department itself. In the absence of this, there is likely to be considerable resistance to the implementation of the IT. The outside agency that implements the IT solution will not be able

[11] *Interview with D. Prakash, IT Secretary, May 1999*

to do it in the absence of impetus internally. The outside agency would provide technical expertise.

★ Private household demand: This will be difficult till efforts are made to raise the economic development level and standards of living in general. (Statistics on diffusion of computers in Tamil Nadu, and comparison with all-India figures).

★ Infrastructure investment: This is a problem if IT is regarded as separate from the rest of the industry. For instance, many of the interviewers, who are top officials of other infrastructure sectors, demonstrated an absence of involvement with the IT sector.

**2.6 Hardware and Equipment Manufacturing:**

The creating of a global information society, has created new opportunities for the development of both software and hardware industries - as well as telecommunications equipment manufacturing. An integrated IT Policy requires emphasis on both software development - which would comprise a services sector, and a hardware sector, which would focus on absorbing manufacturing labour.

Some of the interviewers expressed skepticism about the possibility of developing a local manufacturing capacity, citing a glut in the global market in this segment. However, given that the software sector requiring technically skilled labour is likely to absorb only a limited labour, manufacturing continues to be important to developing countries, and more emphasis needs to be placed on this.

Tamil Nadu has great potential to become a major platform for labour-intensive manufacturing exports. It has all the critical ingredients required for a state to follow such a development strategy. Indeed, with a more open and deregulated economy, Tamil Nadu stands poised to repeat the export boom of China's

southern provinces during the past two decades, based on low labour costs, the availability of managerial and engineering skills within, and the inflow of international capital and technology. Likewise the STPs in the IT sector, export processing zones (EPZs) in the manufacturing sector can play a major role in the overall growth strategy of the state. Virtually all of the East Asian countries have utilized export-processing zones (EPZs) to help attract foreign investment and to initiate the process of manufacturing export-led growth.

EPZs have not aimed to pick "winners" in the classic sense of industrial policy. Rather, they have attempted to carve out a geographical zone in which export-businesses can conduct profitable export-oriented activities, exempt from costly regulations, tax laws, and labour standards that apply more generally within the country. In general, the relatively successful industrial policies have had a few common characteristics: (a) they have aimed to promote exports, rather than to protect the domestic market; (b) they have provided subsidies on the basis of successful performance (e.g. the growth of exports) rather than to cover losses; and (c) they have given temporary rather than permanent subsidies (e.g. a five-year tax holiday for new export firms).

One of the key factors that ensured success of manufacturing private sector firms in the East Asian economies was a very healthy Government involvement in business activities. The extent of Government intervention in industry has differed markedly. Korea has surely been the most interventionist, rather closely modeling its industrial policies on Japanese institutions. Taiwan probably comes next in the extent of Government intervention in industry, though with considerably more market orientation and reliance on small, family businesses as opposed to the large industrial conglomerates (chaebol) supported by state policies in Korea. Southeast Asia, by contrast, has shown considerably less Government intervention in industrial policies than has Northeast Asia (Japan, Korea, and Taiwan). Hong Kong, for example, has

maintained completely free trade, with zero tariffs, quotas, and licenses on merchandise trade.

Singapore as well has essentially maintained open trade, though with more Government intervention via tax policies and other incentives. Indonesia, Malaysia, and Thailand have also pursued rather modest programs of industrial policy in comparison with Northeast Asia. All three have maintained relatively open trade since the 1970s, based on convertible currencies, modest tariff rates, and relatively free markets for capital and labour. While these three Southeast Asian economies have all engaged in some efforts to identify and promote industrial "winners," most of industrial growth, and especially the export growth, has taken place outside of these Government-led attempts.

## CONCLUDING REMARKS

Substantial impetus can be imparted to the growth process should the central Government decentralize economic policy making and allow the states to make crucial economic decisions on their own. Brazil, China, and Russia are examples where regional Governments have taken the lead in pushing reforms and prompting further actions by the central Government. In Brazil, it is Sao Paulo and Minais Gerais which are the reform leaders at the regional level; in China, it is the coastal provinces, and the provinces farthest from Beijing, in the lead; in Russia, reform leaders in Nizhny Novgorod and in the Russian Far East have been major spurs to reforms at the central level. With controlled decentralization in China, for example, provinces have increasingly been competing with each other in terms of attracting investments, both domestic and foreign, and in providing better infrastructure facilities, among other things.

Greater decentralization of decision making in India is likely to lead to greater competition among the states and therefore to higher efficiency and productivity in these regions. In India, key fiscal,

infrastructure, and regulatory decisions on economic management remain at the central Government level. Essentially what this centralized system of governance implies is that the states have very little jurisdiction in, or control over, policy and regulatory decisions that would make the states more attractive to prospective investors. A gradual process of decentralization has begun in India as a result of the fact that regional political parties have been lending support in the formation and running of the Government at the center. This is a healthy development. Coalition Governments at the Center made up of regional parties representing different states can exercise a great deal of influence in policy-making at the Center. Also, this is the most plausible scenario in the Indian democracy wherein the Center is virtually forced to allow greater decision-making to be done at the state-level.

While it is true that the record of the coalition Governments in India so far as stability at the Center is concerned is poor, but it is also important to recognize that coalition politics is rather new to the country, and with the passage of time is likely to mature. Regional parties having representation in the Central Government can play a critical role and negotiate for greater decision-making authority to be transferred to the state-level. Policy making at the sub-national level is essential in order for state Governments to be able to follow development strategies suitable to their socio-economic, cultural, and geographic characteristics. Coastal states, for example, can follow a more focused export-led growth strategy, or states with a large pool of trained manpower, such as IT professionals in Tamil Nadu or Karnataka can lay more emphasis on IT and service sector.

The Tamil Nadu Government can influence the federal Government's IT Policy to do much more to spur growth in the IT industry. On positive side there has been the federal Government's long-term commitment to the Indian Institutes of Technology (IIT). Also, there has been the Government's support for Software Technology Parks (STPs), in the different states. On the negative

side, India's telephone density is abysmally low, at around 1.3 per hundred in 1995, compared with around 62.6 per hundred in the United States. Costs of international telephone calls made from India are among the highest in the world, largely due to lack of competition. Physical infrastructure for data transmission within India (e.g. fiber optic cables) remains underdeveloped despite some progress made in this area during the past few years. Additionally, the lack of enforcement of intellectual property laws most likely inhibits inward investments in IT sectors. All of these problems are remediable through further deregulation of telecom and FDI, as well as effective law enforcement in a more liberalized and competitive environment.

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## APPENDIX 1 : List of People Interviewed

### Government

Mr. G.S. Radhakrishnan, Dty. Secy, Dept. of Finance

Mr. Pravin Kumar, Jt. Secy, Dept. of Industry

Mr. M.S. Srinivasan, Secy, Dept. of Industry

Mr. D. Prakash, Secy, Dept. of Information Technology

Mr. Gnandesikan, CMD, ELCOT

Mr. Neeraj Mittal, Executive Director, ELCOT

Mr. R. Gopalan, CMD, TIDCO

Mr. M.B. Pranesh, CMD, TACID

Mr. Satpathy, CMD, Power Finance Corporation

Mr. A. Balraj, CMD, SIDCO

Mr. S.S. Iyer, General Manager, Chennai Telephones

Mr. Gururaj, General Manager, TIIC

Mr. Ramdoss, CMD, GUIDANCE

Mr. M. Velmurgan, Addl. Dir.GUIDANCE

Mrs. Rajlakshmi, Director, STPI

Mr. Willington, TIDCO

General Manager, SIPCOT

Mr. K. Rajaraman, Executive Dir., TIDCO

### Industry

Mr. Samson Manuel, Branch Manager, BPL

Mr. K. Srinivasan, Director, Pentafour

Mr. C.S. Sridhar, WIPRO

Mr. Gopal Srinivasan, CEO, TVS

Mr. K.V. Ramani, CEO, Future Software

Mr. Ravi Shah, Tata Consultancy Services

Mr. Vaitheeswaran, Tata Consultancy Services

Mr. Shankar, CBSI

Maj. Gen. RPRC Naidu, Metamor

Mr. A.T. Vijaykumar, GM, Hewlett-Packard

Mr. Ramnathan, SIP

Mr. Swaminathan, World-Tel

Mr. R. Sridaran, Mahindra Industrial Park

Mr. Shaktikanta Das, Mahindra Industrial Park

Mr. V. Balakrishnan, Polaris Software

## APPENDIX - 2

## INFORMATION TECHNOLOGY INDUSTRY POLICY OF TAMIL NADU 1997

G.O.MS.No.300, IND (MIE.2) DATED 3rd NOVEMBER 1997

The Information Technology (I.T.) Industry in India is a fast growing segment of the Indian economy, with growth rates exceeding 50% per annum. In 1995-96, the Indian Information Technology Industry comprising hardware, software, peripherals and training had a turn over of Rs. 9037.85 crores. The Hardware Industry in India has mainly catered to the needs of domestic consumers, with only marginal exports. On the other hand, 60% of Software revenues are from exports, and the main growth is in this sector.

Tamil Nadu's contribution to the I.T. industry has been significant . The key elements which have made Tamil Nadu an

important player in this area are availability of skilled and educated manpower, comparatively higher standard of educational institutions, reasonably good infrastructure, and lower costs of operation. Apart from these, the presence of an International Airport and a major Seaport in Chennai have also helped the growth of I.T. industry in Tamil Nadu. After the liberalization process in 1991, and especially after reduction of import duties on hardware in July 1996, multinational companies were able to export large volumes to India, thereby boosting the domestic market for both hardware and software.

Despite all these advantages, Tamil Nadu accounts for only 7% .of the total revenue from hardware and software in the country. The turnover of the industry in Tamil Nadu in 1995-96 was Rs. 289 crores of which Rs. 139 crores was in hardware and Rs. 150 crores in software. The potential for growth of Information Technology in Tamil Nadu is enormous with I.T. penetrating all spheres, including Government Departments, educational institutions, Banking, shopping entertainment and a whole gamut of other consumer applications. The Industry while drawing up the program for the IX Five Year Plan has projected that by the year 2001-2002, I.T. revenue in Tamil Nadu will be of the order of Rs. 13,000 crores (Rs. 5000 crores in Hardware and Rs. 8000 crores in Software). The industry has predicted that this level of achievement can be obtained provided the State Government announces and implements an industry-friendly I.T. policy. With the aim of achieving the goals spelt out in the IX Plan and to focus attention on the I.T. Industry as an engine of growth in the State, it has been decided to formulate an industry - specific policy for the I.T. Industry.

**Objectives of the Policy:**

★ To encourage and accelerate the growth of hardware and software industries and associated services in the State and to remove the bottlenecks for starting and running of such Units in Tamil Nadu.

★ To increase both domestic and export earnings of software and hardware sectors in the State.

★ To upgrade and develop manpower skills required for the I.T. industry by facilitating training, to accelerate the use of I.T. in schools, colleges and educational institutions with a view of providing skills and knowledge to the youth to make them fit for employment in this sector.

★ To upgrade the quality of life of the citizens of the State by facilitating access to consumer application of Information Technology.

★ As part of the above objectives, the Government will also encourage use of I.T. in Government institutions and Departments with a view to improving productivity and efficiency of Government services, revenues and tax collections, and assist in the process of decision - making by Government, and monitoring of Government programs. A high Power Committee headed by the State Finance Secretary has been constituted to draw up a plan for phased use of I.T. in Government Departments. A separate policy paper will be prepared on this for speedy implementation.

**Existing Incentives Available to the Industry:**

★ There is no system of Entry Tax or Purchase Tax in Tamil Nadu. I.T. Industry will continue to enjoy facilities of unrestricted movement of capital equipment including hardware, peripherals, captive power gensets, UPS sets and Telephone Exchanges, subject only to Sales Tax payments as per orders in force.

★ Due to self-sufficiency in power, Tamil Nadu does not have power cuts for industry. The facility of uninterrupted power will continue to be offered to I.T. industry.

★ Tamil Nadu has already announced fiscal and tax concessions for investments of various slabs starting from an investment of Rs. 50.00 crores (mega projects) upto investments exceeding Rs.1500.00 crores (super mega projects). The orders issued in G.O.Ms.No.43, Industries, dated 13.12.1992 (for 'mega' and in G.O.Ms.No.1, projects) Industries dated 2.1.1996 (for 'super mega' projects) will be applicable for I.T. industries also in addition to other incentives.

★ Capital subsidy as applicable to electronics industries @ 20% of fixed assets subject to a maximum of Rs. 20.00 lakhs[12] will be available for all I.T. industries, irrespective of their location in the State. Where the unit is also eligible for capital subsidy for backward / most backward areas, this special subsidy will become part of such subsidy. The existing incentives available for industries employing at least 30% of women workers will also be available to I.T. industries.

**New Initiatives:**

★ The State Government will set up Information Technology Parks (ITPs) at Chennai, Coimbatore, Tiruchirapalli and Madurai in a phased manner through ELCOT during the IX Plan period in association with the private sector. The ITPs will have full-fledged facilities with adequate modules for software development as well as sites for non-polluting hardware units, commercial and residential areas, schools, Convention and Business Centers as well as the connectivity required for communication and information exchange globally.

★ Apart from ITPs in the Government and joint sectors, Government will facilitate setting up of ITPs by the private sector in potential locations for the development of I.T. industries. Private ITP developers will be given assistance in

[12] *Lakh = 100000*

land acquisition and re-zoning, wherever required, by State Government. State Government will also facilitate provision of water, power connection and roads. State Government will also help the ITP promoters in obtaining necessary cable and satellite links through VSNL/DOT for the necessary connectivity. An ITP will be treated as an " industry" and be eligible for backward area capital subsidy and ST benefits.

★ The Government will provide assistance to VSNL and Department of Telecommunications to expand communication links in the State and also provide the land and power wherever required by such agencies. State Government will liaise with Govt. of India to ensure dedicated VSNL connectivity / Earth Stations as well as Electronic Telecom facility for each ITP.

★ All ITPs set up by private promoters will have the same status as ITPs promoted by Govt. agencies for the purpose of eligibility for the concessions / incentives granted by Government from time to time to SIPCOT, ELCOT, TIDCO and TACID industrial estates, subject to conformity to certain quality standards, and subject to location (whether backward / most backward area). Units in private ITPs will be entitled for exemption from stamp duty and registration charges at the time of allotment of sites/ built up space as in the case of units in ELCOT / SIPCOT industrial estates. Private ITP promoters will be granted exemption of tax for works contracts within the complex as in the case of SIPCOT / ELCOT, etc. Software / hardware units set up in private ITPs established in accordance with the standards prescribed by the Government will enjoy the same facilities and incentives on par with units in Government industrial estates.

★ In all the Technology Parks set up by Government & Joint Ventures, there will be an Executive Authority of the Park which will function as the Single Window for all statutory clearances required for the units, within the Parks. In the case of private sector Technology Parks, ELCOT will assist in getting all clearances fast.

- ★ Apart from development of software and hardware Industry through ITPs / STPs the Government will also encourage software development outside the Parks by giving such stand-alone units the same incentives as the Units in the ITPs / STPs. There will be no locational restrictions for setting up units exclusively engaged in software development / training.

- ★ All software industries including Services and Training Institutions in I.T. will be entitled to "Industry" status. Such units shall be eligible for all concessions and incentives applicable to Industries. For the purpose of this clause, accredited Training Institutions will also be eligible to claim industry status, subject to certain norms which will enable them to obtain Term Loans and Bank Finance at industry rates.

- ★ Government will provide continuous power supply in industry rates to all I.T. units, whether set up in ITPs, or in stand-alone locations, and also ensure quality of power as required by the industry. Software Training units will also be eligible for these facilities.

- ★ For the purpose of power tariff, maintenance and servicing units and hardware units will be treated as industrial and not commercial consumers and electricity staff as applicable to Industry consumers will be charged.

- ★ All software industries will be exempted from the purview of Tamil Nadu Pollution Control Act. Hardware units will require clearance from Pollution Control Board as applicable to other industries.

- ★ Government of Tamil Nadu will also facilitate setting up of a T-Net with an "Information Back bone" connecting all District Head Quarters, using the Cable TV network all over the State whose penetrating at present is 4 times that of Telephone lines.

★ Government of Tamil Nadu will encourage setting up of Venture Capital Fund for development of I.T. Industry through TIDCO in association with private sector parTamil Naduers.

**Human Resource Development:**

A subgroup set up to discuss the prospects of the Information Technology Industries in the IX Plan period has assessed the manpower requirements for the industry. The subgroup has estimated that Tamil Nadu manpower in the Information Technology Industry by the end of the Plan period. The following are the policy initiatives planned for Human Resources Development in Information Technology

★ Government of Tamil Nadu will set up an Information Technology Institute of Tamil Nadu (TANITEC) to take care of the training and technology upgradation aspects of I.T. in the State. The Institute will also co-ordinate in preparation of syllabus for I.T. courses in Colleges and Technical institutions, create Centers of Excellence in Universities, and also support funded research program and specific technology applications.

★ Training Institutes for hardware, software, servicing and maintenance will be deemed to be "Industries " and will be eligible for all facilities offered to Industries including Bank Finance and SSI or IEM registration. Certification for Software training will be governed by existing standards prescribed by the Department of Electronics, Government of India. For quality certification of training in hardware, servicing and maintenance ELCOT will be the Nodal Agency to prescribe minimum standards for eligibility.

★ Basic training in computers will be introduced in all schools from the high school level. The endeavour will be to cover all

schools within a 5-year period. Training of teachers will also be done in a phased manner over the 5-year period. In addition to Government sponsored training programs, State Government will facilitate and co-ordinate with other sponsors like INTEL, IBM, APPLE, etc., for training of teachers.

★ Government of Tamil Nadu will encourage I.T. industries to obtain ISO 9000 process certification. Small Scale Industries (SSIs) will be eligible to claim the incentives offered by TIIC for obtaining such certification.

**Special Assistance for Information Technology Industry:**

★ Government of Tamil Nadu will offer relaxation of FSI (Floor Space Index) in metropolitan areas to the extent of 50% for IT. Parks.

★ Government of Tamil Nadu will co-ordinate with Government of India facilitate setting up of ' Internal Container Depot' to take care of exports of specified industrial products through Chennai Port, including products of electronic and hardware units.

★ Government of Tamil Nadu will facilitate setting up an Air Freight City near Chennai Airport, for improving the cargo movement for imports and exports from Chennai Airport. The Air Freight Center will have sufficient space for handling equipment and necessary facilities for customs clearances, with staff posted round the clock. Such a center will be formed as a Joint Venture between TIDCO, TACID, and FIEO. With these facilities, Government of Tamil Nadu will facilitate a 72-hour cycle for import of components and export of finished products by the hardware units.

**APPENDIX : Concessions/Incentives Available for Industries**

**Special Subsidy for Mega Projects:**

★ An industry set up anywhere in Tamil Nadu having an investment of Rs.50 crores and above and below Rs. 100 crores is eligible for a Capital subsidy of Rs. 25 lakhs.

★ An industry set up anywhere in Tamil Nadu with an investment of Rs. 100 crores and above and below Rs. 200 crores is eligible for a subsidy of Rs. 50 lakhs

★ An industry set up anywhere in Tamil Nadu having an investment of Rs. 200 crores and above is eligible for a Subsidy of Rs. 100 lakhs.

**Additional Subsidy for Employing Women Workers:**

New industrial units (small, medium or major) where more than 30% of the total workers employed are women shall be eligible for an additional Capital Subsidy of 5% of investment in fixed assets subject to a ceiling of Rs. 5 lakhs.

**Special Subsidy for Electronics Industry :**

Electronics - 20% of fixed assets subject to maximum of Rs. 20 lakhs.

**APPENDIX 3 : List of Websites Related to Tamil Nadu Economy**

Electronics Corporation of Tamil Nadu (ELCOT)
http://www.elcot.com/

TIDEL Park
http://www.itparkchennai.com

Tamilnadu Industrial Guidance and Export Promotion Bureau (GUIDANCE) http://www.focustamilnadu.com

Tamil Nadu Industrial Development Corporation (TIDCO) http://www.tidco.com

Tamil Nadu Corporation for Industrial and Infrastructure Development Ltd. (TACID) http://www.welcometacid.com

Software Technology Parks of India
http://www.stpi.soft.net

International Tamils Business and Professionals Online
http://intamm.com/index.htm

Tamil Nadu Telecom Circle
http://www.tamilnadu-telecom.com/

Tamil Nadu Industrial Corporation Limited (TIIC)
http://www.tiic.org

Tamil Nadu Chamber of Commerce and Industry
http://epages.webindia.com/india/Tamil Nadu-chamber

Tamil Nadu Foundation, Inc.
http://www.webindia.com/np/us/Tamil Naduf.html

Small Scale Industries Association of Tamil Nadu (TANSTIA) http://www.tanstia.org.in/

Anna University, Tamil Nadu, Chennai
http://www.annauniv.edu/

Tamil Nadu Information
http://www.indiaavenue.com/

## PART - II

# RAISING THE GLOBAL COMPETITIVENESS OF TAMIL NADU'S INFORMATION TECHNOLOGY INDUSTRY

**■ Nirupam Bajpai and Navi Radjou**

### Abstract

The explosive growth of the information-intensive services sector is radically altering the world economic landscape. In the emerging knowledge-based global economy, the sustainable competitive advantage of nations will reside not in their possession of abundant natural resources or cheap labour force, but in their ability to harness their countries' intellectual assets. As such, the knowledge revolution offers a unique chance to those developing countries and sub-regions like Tamil Nadu, with substantial knowledge assets to leapfrog entire stages of development.

This paper argues that in order to assume a leadership role in the making of the global knowledge economy, Tamil Nadu needs to initiate a knowledge-led development policy that builds on the state's successful IT industry. The success of such a growth strategy will critically depend on the international competitiveness of its local knowledge industries. Therefore, an attempt is made in this paper to propose a roadmap to raise the global competitiveness of Tamil Nadu's IT industry.

To be able to put together a comprehensive knowledge-led development policy, Tamil Nadu needs to strengthen the capabilities of not only the supply side, but also the demand side of its IT industry. Indeed a thriving domestic market would provide a spur to the local IT firms, allowing them to hone their product development and marketing skills first at home and then abroad.

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# RAISING THE GLOBAL COMPETITIVENESS OF TAMIL NADU'S INFORMATION TECHNOLOGY INDUSTRY

■ Nirupam Bajpai and Navi Radjou

At the 1999 India-US Summit, appropriately titled 'Dynamic South' and held in Chennai, the US Ambassador in India, Mr. Richard Celeste, said the 'Silicon triangle' in South India (with Chennai, Bangalore and Hyderabad as its vertices) rivaled the Silicon Valley in California.

A later comer to join the Indian IT revolution, Tamil Nadu has nonetheless made remarkable progress in the past five years. Building on the state's inherent advantages -large reservoir of IT skills, low-cost of living, investor-friendly public policies, better-than-average infrastructure- the Tamil Nadu Government has multiplied efforts to attract foreign investment into the local IT industry. In 1998, the state announced far-reaching, industry-friendly IT policy and set up a state-level IT Task Force to implement it. All these efforts have paid off well: software exports have zoomed from nowhere to over US$300 million in 1998. The state's ambitious target for IT hardware alone for the year 2002 is set at US$1.25 billion[1]: if this target is reached, the region's contribution will represent about 30 percent of the entire Indian hardware production.

However amazing Tamil Nadu's success story might sound, a question arises: could Tamil Nadu's IT industry sustain its stellar growth in light of the fierce competition from within and outside India? What are the hurdles that Tamil Nadu needs to surmount before its vision of evolving into an IT superpower becomes a reality? In 1998, Tamil Nadu's share of the global IT market was a tiny 0.035%[2] . On the other hand, Ireland -whose population is

[1] *Government of Tamil Nadu (1997), Information technology Policy*

[2] *India's share in the global IT market today is 0.5% and Tamil Nadu accounts for 7% of the Country's IT revenues.*

just about one-fourteenth of Tamil Nadu's- is today the second largest software exporter after the U.S. Still, Ireland's software industry employs no more than 15,000 people[3], which is less than in Tamil Nadu. Then, what does it take to become a software exports dynamo?

As part of our study, we analyzed the IT policies of countries like Ireland and Israel, which boast of a successful track record in IT development. We also looked into where the global IT industry and the world economy were heading and asked ourselves: What are the most promising IT trends? What impact will the Internet have on societies around the world? What will it take to be a global IT player in the 21st century? Having obtained some preliminary answers to our questions, we took a critical look at the current state of the IT Industry in Tamil Nadu. Our preliminary analysis led us to some crucial observations:

1. *'Servitization' of the world economy requires inclusion of new thrust areas in Tamil Nadu's overall development strategy.* We believe that the Tamil Nadu Government, while maintaining export-oriented manufacturing production as a priority area, may need to lay greater focus on capital and knowledge-intensive service industries such as the IT industry.

2. *IT policies ought to be formulated within the broader context of economic development.* Although IT can positively contribute to all segments of an economy, it is only one piece of the puzzle. It is vital that the Tamil Nadu Government drafts a comprehensive blueprint in which it articulates its strategy for economic development, as Singapore did back in 1991[4]. Such an economic Masterplan, however, needs to emphasize the role of IT as the lynchpin of sustainable economic growth in Tamil Nadu. Furthermore, it needs to encourage all state departments -

[3] *Industrial Development Authority (IDA) Ireland*

[4] *Ministry of Trade & Industry, Singapore (1991), Towards a Developed Nation : The Strategic Economic Plan.*

from Agriculture to Finance to Industry - to become efficient IT users and active promoters of the local IT industry. This paper provides an innovative way to 'cross-promote' IT among Government departments.

3. *Tamil Nadu's current competitive advantages are not sustainable.* In order to become a real world- class IT player, Tamil Nadu needs to evolve from being a low-cost IT supplier to much more of a value-added services provider. Also, increasing competition from within and outside India on cost (China) and quality Israel, Ireland) could rapidly erode the comparative advantages of Tamil Nadu's software industry within 5 to 10 years.

4. *Macroeconomic performance depends on microeconomics (and vice-versa.)* Achieving global competitiveness paradoxically begins with building a strong local base. In his "Findings from the 1999 Executive Survey," Porter notes[5] that "unless there is appropriate improvement at the microeconomic level, political and macroeconomic reform will not bear full fruit." We noticed that Tamil Nadu's:microeconomic foundations are not yet entirely conducive to start a global IT revolution. For instance, one reason why the productivity of Israeli IT workers is so high is because most of them are paid with stock options, a concept still immature in Tamil Nadu IT industry, due to legal restrictions. This paper proposes appropriate improvements at the microeconomic level.

5. *It is vital to create a strong local market.* There are strategic reasons for focusing initially on the domestic market to develop experience and capabilities before venturing into international markets. Tap into opportunities at home. The huge domestic market provides Chinese IT firms to reap benefits of economies of scale. Current IT policies in Tamil Nadu mostly support supply-side: however, it is equally important to bolster demand-side.

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[5] *Porter, M(1999), Microeconomic Competitiveness : Findings from the 1999 Executive Survey, WEF*

6. *IT should act as an equalizer* : evidence from both within and outside India shows that IT-led economic growth, rather than contributing to a more balanced and equitable regional development, might further widen the income disparity between urban and rural areas. Madon points out that contrary to the international reputation earned by Bangalore, the advent of the information age has not affected the overall economic picture of the state, which remains primarily an agricultural State[6]. Out of the total population of almost 50 million people, around 76% live in rural areas, and there is a high incidence of rural poverty in these areas. Tamil Nadu Government may wish to avoid such pitfalls.

7. *The Internet & E-commerce will lead the'Third Revolution'*. Two years ago, the global IT Industry was estimated at $1 trillion dollar. That figure today is dwarfed by the potential market that electronic commerce promises to usher in. According to Forrester Research, worldwide revenues from e-commerce activities could amount to a staggering $3.2 trillion by 2003! We are convinced that the Tamil Nadu IT Industry, by intelligently leveraging its inherent strengths, can secure a decent share of the lucrative Internet software market and eventually emerge as an e-commerce leader. In one of the sections subsequently, we suggest ways to tap into this promising market.

Our paper is structured as following. In the first section we analyze what we call the 'servitization' of the world economy, that is the emergence of the services sector as the principal generator of wealth and employment in both developed and emerging economies. We observe that the astounding growth of the tertiary sector is fuelled by the explosive demand for knowledge-intensive services, i.e., those activities in which information technologies -particularly the Internet- play the role of an enabler. After highlighting the strong positive correlation that exists between IT development and national prosperity, this section concludes that Tamil Nadu needs to significantly accelerate

[6] *Madon, Shirin, Information Technology Development in Bangalore*

development of its knowledge-intensive services sector in order to achieve sustainable economic growth.

In the second section, we present our key findings about the Indian, and more specifically Tamil Nadu, IT industry. We identify the major characteristics of the Tamil Nadu IT industry and highlight its strengths and weaknesses. We also position Tamil Nadu against its competitors. In the third section, we provide a roadmap to make the Tamil IT industry globally competitive. We believe that in a country like India with a large domestic market, enhancing supply-side capabilities alone is not sufficient. The Government should also support the demand side in order to provide a spur to the local IT industry. Denying from international best practices, we propose a series of measures that the Tamil Nadu Government could follow to create a vibrant domestic IT market and develop the local IT industry capabilities. Taken together, these supply-side and demand-side enhancement policies constitute a comprehensive IT-led growth strategy that will help Tamil Nadu emerge as a key player in both the national as well as the $2 trillion global IT industry.

The key feature of our study resides in the fact that most of our arguments are illustrated with examples derived from countries with a proven track record in IT development. We believe we can learn much from the successes and failures that other nations have had in implementing their own IT policies. Our recommendations therefore rely on international best practices. Nonetheless, we realize that sometimes a particular policy that was successful elsewhere might not necessarily work in the context of Tamil Nadu. In those special cases, Tamil Nadu needs to act as a trail blazer by pioneering the implementation of innovative policies. And that is the beauty of our digital economy: it offers a level-playing field for emerging economies like India to try some innovative policies that, if successful, will provide it with a comparative advantage over developed countries.

Finally, our study also aims to challenge several misconceptions associated with IT development and globalization as pertaining to developing nations like India :

★ *Even in an era of increasing globalization, local economic circumstances do still matter.* For developing nations, globalization starts ... at home! Undoubtedly, the first step in a successful global IT strategy is the creation of an institutional infrastructure that supports the establishment and growth of a local IT industry. This involves the development of a strong local entrepreneurial base, massive investments in human resource development and the promotion of local centers of innovation[7].

★ *Innovation centers need to be tightly integrated with rest of the economy.* While export-processing zones (EPZs) and software technology parks (STPs) offer a hassle-free working environment that encourages the free flow of ideas within its boundaries, they don't necessarily encourage firms operating inside to build linkages with the local economy and thus transfer capital, knowledge and technology to the rest of the society. Consequently, while continuing to develop EPZs and STPs on the one hand, pursuing other innovative approaches like'cluster's on the other hand may help tap into additional knowledge spillovers[8].

With the Indian IT industry is fast becoming the single largest contributor to the country's export revenues, the only way Tamil Nadu can achieve sustainable economic growth at the state level is by strengthening the global competitiveness of its IT industry.

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[7] *Porter's Perspective (1998), Competing in the Global Economy, Working Knowledge, Harvard Business School*

[8] *Porter, Michael (1998), Clusters and the New Economics of Competition, Harvard Business Review*

## SECTION 1: THE WORLD EMBRACES THE KNOWLEDGE ECONOMY

### The 'Servitization ' of the World Economy

Indications are multiplying these days that the world is rapidly making a transition from an industrial to a knowledge-based economy. In some parts of the world, that transition has already occurred. In June 1999, a pathbreaking study found that the Internet-based knowledge economy generated US$300 billion in U.S. revenue and created 1.2 million jobs in 1998 alone. In just five years, it has already outpaced century-old industries like the energy sector (1998 revenue: US$223 billion) and could catch up with the auto industry (US$350 billion) next year. Also, the average revenue per Internet economy worker is about US$250,000, or about 65 percent higher than their industrial economy counterparts[9]. While the second industrial revolution was initiated in the labour-intensive manufacturing industry by automotive pioneers like Ford, it is clear that the third revolution is driven by the knowledge-based services sector. Today, and in the future, it is "brain" and not "brawn" that is the key to sustainable economic growth[10]. Consequently, the level of development of the services sector, particularly the knowledge-intensive segments of it has become a key determinant of national competitiveness for economies around the world.

Against this backdrop, a developing country that aspires to achieve rapid growth and join the global knowledge economy ought to encourage the development of its services sector. This sector has been the engine of growth and employment in developed economies. In the post World-War II period, it has led GDP growth in these economies, more than doubling its share of GDP in the last 5 decades and substantially increasing its share of employment. In the U.S., which leads the global IT revolution, services contribute to almost 80% of

[9] *Findings of this first-ever study, funded by Cisco Systems are available at www.internetindicators.com*

[10] *Neef, Dale, Anthony Siesfeld and Jacquelyn Cefola (ed) (1998) The Economic Impact of Knowledge*

GDP. In Singapore, it accounts for 72% of GDP[11]. In Ireland, the second largest software exporter in the world, the service industries employ 65% of the working population.

Paradoxically, a key contributor to the 'servitization' of the world economy has been the non-services sector. Companies engaged in every type of commercial activity, be it in agriculture, manufacturing, finance or Government- rely on the competitive edge that services firms offer to be integral to their business success. This often is not apparent until you look in the annual reports of MNCs. For instance, unlike what its name may suggest, General Electric today derives most of its income not by selling electrical appliances, but financial services. Its financial arm, GE Capital, is today one of the world's leading financial service company with assets worth over US$300 billion. At General Motors, #1 in Fortune 500, the auto financing business (GMAC) brings home more revenue than actual car sales!

From an economic development perspective, there are many compelling reasons for emerging economies to develop their services sector. To begin with, expanding this sector helps create national wealth: a positive correlation exists between high GDP per capita and the intensity of services activity in the economy, mostly because compensation levels in this sector normally surpass those in agriculture and industry. Moreover, in economies with a strong emphasis on services, people tend to climb the "value-chain ladder" much more rapidly. Finally, since services businesses are typically skill -and not investment- intensive, they are ideal sources of growth for countries with scarce capital and a large, qualified workforce. India, which possesses the world's second largest pool of scientific manpower, stands much to gain by developing its service industries. In particular Tamil Nadu, whose capital - Chennai- is known as the 'academic capital' of India, will benefit enormously by accelerating the growth of its tertiary sector, which contributes today to merely 48% of SDP. It is therefore imperative that the Tamil Nadu Government takes proactive measures to create a vibrant knowledge-based services sector in the state.

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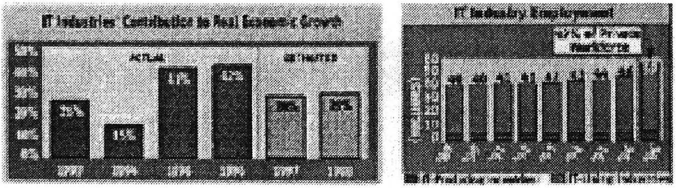
[11] *CIA World Fact Book 1998*

## E-commerce and Globalization Accelerate Transition to Knowledge-based Economy

The year 1998 heralded not only the preeminence of the services sector but also the key role played by Information Technology (IT) within that sector. Information services have become fundamental to the overall growth and development of the U.S. economy and others around the world[12]. In August 1999, the United States Postal Service acknowledged this by approving the use of the world's very first electronic stamp, provided by E-Stamp.com[13]. For a long time however, it was difficult to evaluate the economic impact of the IT sector. Data made available now allow us to demonstrate its positive effects on worldwide economies. In June 1999, the U.S. Department of Commerce released "The Emerging Digital Economy II," a far reaching document[14] that highlights the strong correlation between IT and national prosperity. This report finds for instance that, between 1995 and 1998, the IT industries, comprised of IT producers and users, contributed to an amazing 35% of the U.S. real economic growth. Also, almost half of the U.S. workforce is expected by 2006 to be employed in IT-based industries (Figure 1)

**Figure I: Information Technology Drives U.S. Growth**



Source: U.S Department of Commerce, The Industry Standard, July 1999

*[12] In 1998, more E-mail than "snail mail" was sent in the U.S. and phone lines carried more data than voice*

*[13] E-Stamp is an Internet startup founded by Salim Kara, an entrepreneur of Indian origin.*

*[14] The 1999 report builds on the findings of last year edition, but focuses more on the emergence of E-commerce*

The most remarkable facet of the emerging "digital economy" is of course the Electronic Commerce. The Internet, which enables E-commerce, is radically changing not only the way businesses serve and communicate with their customers, but also the way they manage their relations with suppliers and parTamil Naduers. Both the new Internet-based companies and the traditional producers of goods and services are transforming their business processes into e-commerce processes in an effort to lower costs, improve customer service, and increase productivity (DOC, 1999). The value of e-commerce transactions worldwide is growing exponentially and is expected to reach US$3.2 trillion by the year 2003. Driven by customer demand and business imperatives, the digital economy is becoming truly global. As of May 1999, 171 million people across the globe had access to the Internet, over half of them in North America[15]. While North America and Europe occupy a large absolute share of the Internet world, Asia-Pacific is catching up fast. It is estimated that by 2003, the Asia-Pacific region, with 81 million Internet users, will overtake Europe and become the world's second largest Internet user population (IDC). Singapore for instance has already launched an ambitious e-commerce initiative with the target of S$4 billion products and services transacted electronically through Singapore, and 50 per cent of businesses to use e-commerce by 2003[16].

The Internet, apart from enabling e-commerce, is also contributing to the rapid internationalization of the services sector. It makes it possible to unbundle the production and consumption of information-intensive service activities. These activities e.g., computing, accounting, personnel, marketing, distribution, etc.- play a fundamental role not only in service industries but also in manufacturing and primary industries. As much as 75 percent of employment in manufacturing in the U. S. may be associated with service activities (World Bank, 1995). Typically, MNCs process at home the value-added services

[15] *Nua Internet Surveys, 1999 (www.nua.ie)*

[16] *Full details on Singapore Government's E-commerce policies are available online at www.ec.gov.sg*

and outsource those with high labour-content to low-cost international service providers. India and the Philippines have thus emerged as favourite destinations for software outsourcing. Lately however, IT Enabled Services (ITES), or "remote processing," which involves using software rather than writing it, is being described as the next major driver of technology-led services industry. These services (e.g., customer interaction services) typically involve a much higher degree of consumer-provider interactipn and bring in more revenue. Riding on the popularity of the Internet, this knowledge-added services market is expected to skyrocket to $200 billion by 2010, according to McKinsey & Company[17]. Several countries around the world, like Ireland, Philippines, India and China, are vying for a piece of this lucrative pie.

## Knowledge-Based Economic Development : A "Sure Path " to National Prosperity

In this section we highlighted the strong positive correlation that exists between the development of a knowlege-based services sector and national prosperity. This correlation has not been lost on countries around the world, which are multiplying IT development efforts in order to reap benefits of the emerging digital economy. Some have made notable strides: Ireland, which ten years ago was considered as a low-end manufacturer, is today the second largest software exporter in the world after the U. S.

Inspired by the success of Singapore, several developing countries consider IT as a unique opportunity to leapfrog whole stages of industrial development. Having missed the first 2 industrial revolutions, they are eager to not miss the third one - the making of the knowledge economy. A few developing countries are indeed closing the gap, some of them at a breathtaking speed. In China, five years ago, just one percent of the population owned a telephone. Today, more than 110 million people, or 10 percent of the population, have one. China's

[17] *Far Eastern Economic Review, "At Your Service," September 2, 1999*

Internet users are expected to grow from 4 million by end of this year to 10 million by 2000,compared to a paltry 1.5 million in India the same year. China is aggressively developing its IT-based services sector. Between 1980 and 1990, China's agricultural sector grew at almost 6 percent per annum, while its services sector grew at an astonishing 13.1 percent per annum. China's service sector activities used to be labour intensive, but are now increasingly capital and knowledge intensive as China is determined to emerge as Asia's services hub in the 21st century.

Now that the comparative advantage of nations lies in the application of knowledge, rather than on cost advantage, economists are worried that wealth creation in the next century won't be equally spread around the world. In his most recent book, "Building Wealth," Thurow (1999) warns that global disparities are likely to become even wider as what he calls the "knowledge revolution" plays itself out. Whereas in the past wealth creation depended on the ownership of equipment or natural resources, in the future it will depend on control over knowledge. To gain stature in the global village of the next millennium, he warns, it is no longer enough to maintain free markets, invest in human and physical infrastructure, nurture the rule of law, and build democratic institutions. Unless they rapidly build a vibrant knowledge-based services sector, the developing world might slide down the global value chain and slip lower on the slopes of a much steeper pyramid of world power (FEER, 1999). In order to achieve sustainable economic growth and be able to join the global knowledge economy, Tamil Nadu needs therefore, to accelerate the development of its services sector. Innovative Government schemes are needed to boost the SDP share of services from the present 48% to at least 60% over the next five years.

Identifying and developing growth industries is not a static process. As their competitive strengths evolve over time, countries will need to shift their thrust from one growth sector to another. For example, in the 1960s and 1970s, South Korea relied on its low labour costs to build a strong global position in labour intensive and export-oriented

manufacturing industries. However, since labour cost is not a sustainable competitive advantage, South Korea has gradually shifted its focus to knowledge-based industries. Likewise, Tamil Nadu might have to de-emphasize some fields and stress others as it moves up the ladder of economic development. Tamil Nadu has intelligently exploited the state's inherent strengths to build a world-class base for auto manufacturing. By marshalling those very skills and best practices that helped it become a manufacturing success in the auto industry, Tamil Nadu now stands a bright chance to emerge as an IT-based services hub within Asia. Having established its reputation as the "Detroit of India," Tamil Nadu must now strive to build worldwide recognition for being the "Cyber-capital of India."

## SECTION 2 : KEY FINDINGS FROM THE TAMIL NADU IT INDUSTRY

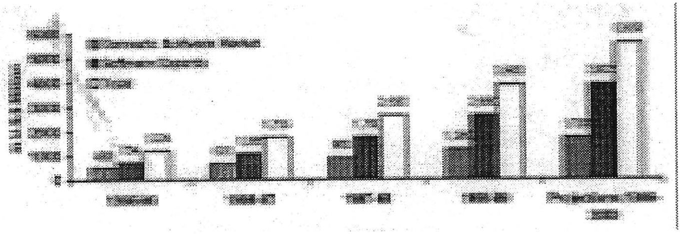
### The Indian IT Scenario

The engine of growth of the booming Indian IT sector is the software industry, which has grown at an average annual rate of 60% between 1992 and 1999. The Indian software industry, which today employs 160,000 professionals, has zoomed from a mere US$20 million 10 years ago to a whopping US$4 billion in 1998-99, of which US$2.6 billion was exported. The industry has clearly emerged as a major export earner for the country, contributing to 8% of total merchandise exports. It has also achieved worldwide reputation for providing excellent quality: many local software firms have earned ISO 9000 as well as SEI-CMM certification, with five of them having reached Level 5[18] (only 9 firms worldwide have reached this level). India has achieved this feat by leveraging its most valuable resource: highly skilled manpower. The country today boasts of the second-largest English-speaking pool of scientific manpower in the world and graduates 70,000 computer professionals every year, in addition to the graduates from the prestigious Indian Institute of Technology (IIT).

*[18] Level 5 of Capability Maturity Model for Software (CMM) indicates the highest level of excellence in quality.*

Technical excellence explains why India was identified by 82% of American companies as their top destination for software outsourcing, according to a World Bank survey[19].

**Figure 2 : Stellar Performance of the Indian Software Industry**



*Source :* NASSCOM, 1999

Realizing the strategic importance of IT for the country, the Indian Government has set itself an ambitious target of making India a Global IT Power and a key contributor to the world IT industry by 2008. In 1998, a National IT Task Force was set up and a National IT Policy formulated. The policy calls for rising the software industry's turnover to US$85 billion by 2008, $50 billion of this coming from exports. It also proposes to strengthen the country's human infrastructure through the establishment of an Indian Institute of Information Technology (IIIT) in every state. Emboldened by the thrust given by the federal Government to IT development, 14 of the 26 state Governments have already come up with their own IT policies that aim to leverage the comparative advantages of their respective states. Tamil Nadu's IT policy, presented below, is one of the far-reaching and most comprehensive among all of them.

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[19] *Business Week, NASSCOM - Indian Infotech Goes Global, Special Advertising Sections, July 1999*

Eager to climb up the value chain, the Indian IT industry is at present aggressively pursuing two hottest segments: Electronic Commerce and IT Enabled Services :

★ *Internet & E-commerce Opportunities :* with Internet access now liberalized, Indian IT firms are eager to tap into the lucrative Internet software and services market. Goldman Sachs Asia predicts that by 2003 India will have 9 million Internet users and 400 ISPs. E-commerce is also taking off in India. According to IDC (India), Indian eBusiness revenues will grow from US$14 million in 1999 to $51 million in 2000 and reach $162 million in year 2001. Intel CEO Craig Barrett has recommended the Indian National IT Task Force to focus on value-added Internet software applications if it seeks to become a global software leader. NASSCOM forecasts that India could earn at least US$I billion from exports of eBusiness software solutions in year 2002.

★ *IT Enabled Services (ITES) :* as mentioned earlier, value-added 'remote services' like back office operations, call centers, medical transcription, etc, could some day make India's US$3 billion software exports in 1998 look like a paltry figure. The worldwide ITES market is poised to grow from the present US$IO billion to US$180 billion by 2010. According to NASSCOM, 25,000 Indians are currently employed in remote services[20]. McKinsey & Company thinks that this number will rise to lm-3m people within ten years[21]. In July 1998, the Indian Government proposed to exempt remote services' export earnings from corporate tax, putting the business on the same footing as software.

**The Tamil Nadu IT Scenario**

Tamil Nadu has always been a front-runner in the industrialization process in India, both in terms of industrial output and also of

[20] *NASSCOM has even setup a Web site to promote the Indian ITES market (www.teleworkingindia.com)*

[21] *The Economist, "Spice Up Your Services," january 16, 1999*

encouraging various new large-scale projects. At present, the state accounts for over 11% of India's industrial output and contributes to 15% of the country's exports. Its economy is.goised to become the second largest in India by 2000. It boasts of a well-developed infrastructure (second best in India), a large reservoir of talent that has earned it the reputation of 'intellectual powerhouse' within India. These strengths, combined with a global orientation and investor-friendly bureaucracy, have allowed Tamil Nadu to emerge as a top destination for foreign investments in India. Latest CMIE statistics indicate that Tamil Nadu now holds the no. 1 rank in the country in investment cumulatively from mid-91 to April 99[22]. Tamil Nadu has already leveraged its strong industrial foundations to emerge as a manufacturing hub within India, particularly in the automotive industry, attracting major players like Ford and Hyundai.

Tamil Nadu is now trying to climb up the value chain of innovation and intends to become a major player in the global IT industry. Its Government has recognized IT as a thrust area that has the potential to accelerate economic development of the state. It has multiplied efforts to create a business environment in the state that is conducive for rapid IT development. In 1997, it became the first Indian state to announce a comprehensive IT policy; and it later set-up a special Task Force, with representatives from Government, industry and academia, to oversee its implementation. It has also established an IT Department- another first in India- to speed-up the adoption of IT within the entire administration. What makes Tamil Nadu's IT policy unique is its dual-focus on both the 'demand' and 'supply' side of the IT market, as well as its willingness to address both the 'physical' and 'institutional' infrastructure issues, an objective often neglected by other Indian states.

The IT industry in Tamil Nadu has lately been performing extremely well, growing at a higher rate than its competing neighbour states. In 1998, its software exports alone, valued at US$300 million[23]. contributed

[22] *IT Department, Government of Tamil Nadu*

[23] *IT Department, Government of Tamil Nadu*

to 15% of the country's software exports. Tamil Nadu today has the largest number of software professionals in India and also boasts of the largest mainframe computing capacity in the country. Chennai, the state capital, is fast emerging as a prominent development center for multimedia software applications: Pentafour, a local IT firm, now designs multimedia content for Hollywood animation movies. International software majors like Alcatel, EDS and IBM have already opened office in Chennai. Domestic software giants like TCS, Infosys and Wipro, too, operate large development centers in Chennai. A NASSCOM study has rated Chennai as the best location for setting up software projects within India.

In light of the proposed Government initiatives and the current state of the local IT mdustry, we now want to assess TAMIL NADU's potential to emerge as a leader in the global knowledge economy. The World Bank(1999) notes that in order to grow knowledge intensive industries and facilitate their societies' integration into the knowledge economy, developing countries need appropriate infrastructure. They need both 'hard' infrastructure, such as transport and communications, and 'soft' or institutional infrastructure, such as effective legal, financial, and educational systems. Using this as a framework of reference, let us look at how successful Tamil Nadu has been in developing both its 'soft' and 'hard' infrastructure.

**Institutional Support**

Undoubtedly, the first step in a successful state-level IT development strategy is the creation of an institutioiial infrastructure that supports the establishment of an IT industry Bajpai and Dokeniya (1999). The Tamil Nadu Government scores high in this regard. It has setup a forward-looking technocratic structure that acts as a major catalyst for IT development in the state. This structure is made up of the IT Task Force, that provides IT policy guidance, the IT Department, which oversees the implementation aspects of the IT policies, and the Electronics Corporation of Tamil Nadu (ELCOT), which acts as a " single-window" agency for all

IT-related investments in the state. The key strength of this technocratic institution is its determination to drum up grass-root support in the administration for each of its IT policy initiatives before implementing it. Seeking such widespread endorsement is a good move and needs to be maintained since grass-root support is very critical for the success of major IT projects such as "E-Governance," which aims to make the administration more efficient and responsive.

While the institutional support for IT development is very strong in Tamil Nadu, it may need to be strengthened in certain areas:

★ *Access to Private Capital.* This is a key issue[24]. While funding support is today available from SIPCOT, ELCOT as well as the State Venture Capital Fund, they do not offer to entrepreneurs the extra benefits that private venture capitalists can provide: guidance and business contacts.

★ *Single Window Clearance.* This scheme so far has benefited mostly investments made in IT Parks Bajpai and Dokeniya (1999). It needs to be extended to all IT investments, irrespective of their final destination.

★ *Foreign IT investments.* Large IT investments still need to be cleared by FIPB, a process that could take weeks or even months, which is too long from the IT business perspective. The Tamil Nadu Government may want to impress upon the Center to let local administration expedite clearance of large IT investments in the state.

★ *Demand-side Policies.* The institutional support mostly focuses on market-enhancing policies. As we explain in Section 3, IT development policies need to target both demand and supply.

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[24] *Bajpai and Sachs (1998) note that venture capital, which is key for nurturing new industries, is very weak in India.*

- ★ *The Chennai Focus.* IT development efforts need to be extended to other regions of Tamil Nadu as well, in order to avoid uncontrolled urban development in the capital city.

Section III highlights institutional mechanisms to strengthen each of these areas.

**State of Preparedness of the Tamil Nadu society**

Another favourable factor for Tamil Nadu in joining the knowledge revolution is the advanced level of preparedness of its society. The state today boasts one of the highest literacy rates thanks to the emphasis on universal education by successive state Governments. It also has a high teledensity, with 75% of rural areas having access to telephones. Moreover, PC penetration rate in both business and society "has traditionally been higher in the state compared to the rest of India[25]." The recent introduction of computer science as an elective in all state high schools is a step in the right direction to achieve the Government goal of 100% computer literacy in Tamil Nadu within 10 years[26]. Furthermore, the 1,000 Internet Community Centers (ICCs) being set up by WorldTel all through the state will ensure that even remote areas reap the benefits of the Internet. Finally, the adoption of a coding standard for the Tamil font, along with other initiatives (e.g., Tamil Virtual University) aimed at using IT as a tool to promote the Tamil language and culture will go a long way in raising IT awareness in the society. All these Government initiatives should help enhance public knowledge, and understanding of IT.

**Infrastructure Development**

Any developing country that wishes to become a knowledge-based economy needs to make infrastructure development its top

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[25] *Inerview with S. Mahalingam, EVP at Tata Consultancy Services (TCS), August 1999*

[26] *Government of Tamil Nadu (1997) Information Technology Policy*

priority. Tamil Nadu, relative to other Indian states has some of the best infrastructure facilities. The Government is deeply committed in attracting foreign investments in this sector. Actually, 60% of all new investments that Tamil Nadu attracted during the 1990s were in its infrastructure sector. Lately, Tamil Nadu has been actively upgrading its telecom infrastructure. VSNL is already making huge investments to upgrade facilities in Chennai with additional Earth Stations to increase the bandwidth. However, major improvements are still needed[27]. The IT executives we spoke to complained about bandwidth constraints when communicating over the Internet within the country. We heard similar complaints from foreign IT investors as well. Mr.Prakash, IT Secretary, acknowledges that "the problem is the general state of the internal telecom infrastructure[28]" Private sector representatives note that once the state-wide high-speed fiber optic network by WorldTel is laid out, the Tamil Nadu Government could try to convince the Central Government to let the local Railway Authority and Electricity Board provide last-mile access. Both public and private sector officials we interviewed recognize nonetheless that the telecom bottleneck is a "national" issue and therefore the state Government can't address it directly. The Central Government needs to realize that the services revolution places a premium on the development of a competitive telecommunications system (World Bank, 1995).

Hi-tech parks are another important part of an information infrastructure. Regional development theorists have pointed to the significance of high-technology zones as contributing to general economic welfare, through the diffusion of economic benefits Bajpai and Dokeniya (1999). Consequently, the Tamil Nadu Government is setting up TIDEL, a 1 million-sq.ft. software

[27] *At Dynamic South '99, Jeffrey Sachs pointed out that in a survey conducted by HIID among investors in 53 countries, India came first among the 53 countries in the IT sector but ranked dead last in infrastructure.*

[28] *Interview feedback provided by Mr. Prakash, IT secretary, August 1999*

technology park in the heart of Chennai at a cost of US$ 75 million, as well as two other IT parks near Chennai. "Once these IT parks are completed, Chennai will be much more competitive in attracting software projects coming to the Indian sub-continent," notes Mr. S Mahalingam, EVP at TCS. We would like however to observe two points :

★ In addition to Chennai, the Tamil Nadu Government needs to actively create infrastructure for software development in other major cities like Coimbatore, Madurai and Trichy. This will ensure that Chennai doesn't become congested and will also help spread the benefits of IT development across the state.

★ In addition to IT Parks, the Government may wish to promote "IT Zones." Companies that wish to settle in IT Zones would be free to build their own facilities according to their own specifications. This 'grow-as-you-need' model with help foster a stronger sense of'community' among its occupants.

**Human Resource Development**

To successfully integrate into the global knowledge economy, a country also needs quality work force. Tamil Nadu however seems to have no dearth of talent. It has the largest number of software professionals in India and produces 4,000 computer science graduates every year. "There is no denying the fact that in terms of talent availability in the field of IT, Tamil Nadu rates much higher than most other Indian States," acknowledges HCL Executive Vice President R. P. Singh[29]. The 1997 IT policy has also provided for the diffusion of IT know-how throughout the state. Moreover, in order to fill the gap between formal academic training and industry demand, the Government has set up Tamil Nadu Institute for Information Technology (TANITEC). Modeled on Stanford University, TANITEC's objectives are to upgrade the

[29] *SiliconIndia, "Software Sunrise in Chennai", January 1999*

quality of IT training in Tamil Nadu and accelerate the computerization of the state administration. Besides offering undergraduate and graduate training program, it will also conduct cutting-edge research and will provide software testing certification services. TANITEC's equity ownership is equally split between Government and industry. This shareholding mechanism allows TANITEC to extend technology into industry and other institutions in the state. "The idea is to make TANITEC propel;Tamil Nadu into becoming an'intelligent state', the ideal that Singapore is close to achieving," observes N Vittal, Chief Vigilance Commissioner of India and Chairman of TANITEC's founding committee[30].

We have seen so far that Tamil Nadu has been quite successful in developing both its 'soft' and 'hard' infrastructure. Its telecommunication infrastructure however still needs to be improved, but this can't be done without strong support from the Central Government. By marshalling its inherent strengths however, Tamil Nadu should be able to integrate into the global knowledge-led economy. It also offers an ideal environment for the development of knowledge intensive industries like the IT sector.

## The international competitiveness of the Tamil Nadu IT industry : comparison with Ireland, Israel and the Philippines

### IRELAND :

★ *Most relevant data :* Second largest software exporter in the world after the U.S. The top 10 independent software companies in the world have significant operations in Ireland and today over 40% of all PC package software sold in Europe is produced here.

[30] *"Learning to Learn", The N. Vital Column, Rediff on the Net (www.rediff.com), September 22, 1997*

- ★ *Interesting Fact :* all major U.S. software editors (Microsoft, AOL) use Ireland as a stepping stone to release the European versions of their software.

- ★ *Key Shengths :* large pool of highly talented, low-cost workforce; very proactive Government; highly sophisticated telecommunications infrastructure Weaknesses: small domestic market; heavily dependent on exports; faces competition from Europe.

- ★ *Best Web Site for Info on local IT industry :* IDA Ireland (http:/www.idaireland.com)

- ★ *Marketing Strategy :* project Ireland as the gateway to Europe; as a 'services hub' for teleservices

**ISRAEL :**

- ★ *Most relevant data :* outside of the Silicon Valley Israel has the highest number of start-ups.

- ★ *Interesting Fact :* Dozens of start-ups have focused on Internet products, making Israel the world's second-largest developer of Internet products outside the U.S., accounting for 15% of all Internet technologies. Mirabilis, a local start-up, was sold to American Online (AOL) for US$300 million.

- ★ *Key Strengths :* vibrant Venture Capital industry (estimated at over US$3 billion); top-notch educational institutions; great R&D talent (IBM) has a Research Lab here); Government incentives

- ★ *Weaknesses :* small domestic market; heavily dependent on export.

★ *Best Web Site for Info on local IT industry* : Israeli Association of Software Houses (IASH) http.:/www. iash.org.il

★ *Marketing Strategy* : project Israel as the gateway to Middle-East; increasingly targets upstream, highly added value activities of software development like design and R&D

**THE PHILIPPINES :**

★ *Most relevant data* : wage costs for white-collar employees are 10%-20% of U.S. wage costs

★ *Interesting Fact* : America Online's subsidiary employs 600 Filipino customer-service employees who answer 10,000-12,000 technical and billing inquiries a day, mostly from the U.S., or about 80% of AOL's customer e-mail.

★ *Key Strengths* : talented, English-speaking workforce; good educational infrastructure; strong links with the U.S.

★ *Weaknesses* : small domestic market; the combination of environmental obstacles, lack of policy coherence and lack of effective industry coordination creates serious problems in promoting IT use and developing a national IT industry in the Philippines (CRITO, 1995)

★ *Best Web Site for Info on local IT industry* : Department of Science & Technology (www.dost.gov.ph)

★ *Marketing Strategy* : position itself as best place for offshore programming and increasingly for IT Enabled Services ('remote services')

## SECTION 3: RAISING GLOBAL COMPETITIVENESS OF TAMIL NADU's IT INDUSTRY - DEVELOPMENT OF IT DEMAND & IT SUPPLY GO HAND IN HAND

It has been argued that the presence of an information technology industry in itself might not assure IT-led growth for the entire economy[31]. While policies to make a local IT industry globally competitive may at the outset sound like a purely supply-side enhancing initiative, they often work in par with policy mechanisms that support the demand side. In countries like Israel and Ireland, which have a small (but sophisticated) domestic market, a heavily export-dependent economy and a well developed IT infrastructure, IT development policies that aim to raise global competitiveness of the domestic IT industry would most likely place emphasis on the supply-side. However, for large countries like China, India and Brazil, with a big population, low IT awareness and underdeveloped IT infrastructure, a more comprehensive set of IT development policies are needed to boost the global competitiveness of their local IT firms. We believe that developing countries like India, with a huge domestic market, in addition to their IT export strategies, need to equally focus on creating local demand for IT products and services.

So far, Indian IT development strategies have mostly focused on attracting foreign investments into the local IT industry and exploring market opportunities in the Western Hemisphere. Today, more than 60% of India's software revenues are from exports. Even the increase in size of the domestic IT market is largely due to the booming demand for imported IT products. The National IT Policy, released in 1998, highlights the importance of developing

[31] *According to Bajpai and Dokeniya (1999) this will be based more importantly on the success with which IT is applied for economic growth and productivity generally. They point out that while the application of information and communications technology to the Government and industry is a demand-side issue, establishing a local information technology industry, through both domestic and international investment as well as the provision of a telecommunications infrastructure are essentially supply-side issues.*

a policy framework and industrial strategy designed for making the Indian IT industry strong enough to meet the demands of a zero duty regime under the WTO - ITA by the year 2003[32]. However, most of its major targets, like achieving $50 billion software revenues by 2008, are set taking exclusively exports into consideration. As a result of this emphasis on export-led strategies, the local IT market remains underdeveloped. Annual PC sales in India currently amount to no more than 1 million units, less than 1% of the global market. At 1.1% of GDP, the country's IT spending is also among the lowest in Asia[33]. The lack of public initiatives to support the demand side has thus restricted the diffusion of the benefits of the information revolution. A case in point is the state of Karnataka. Gopal Srinivasan, CEO of TVS Electronics, notes that while Bangalore has developed a flourishing IT industry, "Karnataka is relatively poor in the diffusion and application of IT.[34]"

As a recent player to join the IT revolution, Tamil Nadu is in a unique position to avoid errors made by other Indian states that have laid too much emphasis on export-led strategies, and have neglected the domestic market. We suggest that the Tamil Nadu Government, in addition to attracting foreign investments into the state IT industry, also multiplies initiatives to boost local demand for IT products and services. As we explain below, an increased demand constitutes a spur to the IT industry itself, enabling it to become globally more competitive. Consequently, we intend to use the first part of this section to highlight the domestic market opportunities that exist for local IT firms, both within Tamil Nadu and, more broadly, within India. We will also examine the role of the Tamil Nadu Government in helping develop the domestic market. In the second part, we will highlight policy mechanisms to strengthen software industry capabilities and export networks.

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[32] *Government of India (1998) National Informatics Policy*

[33] *IDC India, 1999; IDC Asia Pacific, 1999*

[34] *Bajpai and Dokeniya (1999), IT-Led Growth Policies: A case Study of Tamil Nadu*

Taken together, both these supply-side and demand-side enhancement : policies constitute a comprehensive IT-led growth strategy that will help not only raise the global competitiveness of the local IT industry, but also spread the benefits of the IT revolution to the world wide 80-million strong Tamil society.

**Tapping into the Domestic Market**

While India's IT development policies are characterized by their export orientation, IT policies in other developing countries, who also share India's aspiration for global IT leadership, are based on a dual-strategy that aims both to support local demand and integrate their local IT industries into the global economy. China, for instance, has recently multiplied its efforts to boost its domestic IT market. As a result, China's IT market is the fastest growing IT market in Asia: after increasing at more than 40% annually in recent years, it is poised to achieve a 1998-2003 compound annual growth rate (CAGR) of 27.8%[35]. In 1998, the overall IT market in China reached US$10 billion, which enabled China's IT market to surpass Korea and become the second largest in the Asia/Pacific region (excluding Japan). IDC expects China to surpass Australia and become the largest IT market in the region by 2000, with a total value of US$I5 billion. By early 21st century, China is expected to have the largest number of PCs in Asia. Naturally, such a huge domestic market has attracted almost every single major U.S. IT company: IBM has already set-up an R&D lab in Beijing to conduct research exclusively on Chinese software development. By leveraging economies of scale offered by the large Chinese market, several domestic Chinese software vendors have emerged as leaders in several niche areas: WPS97 developed by Kingsoft remains the best-selling word processing software while Kelihua Software ranks first in education software[36].

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[35] *IDC Asia Pacific, 1999*

[36] *Business Week, "Move Over, Microsoft," November 1996*

Analysts have pointed out that there are strategic reasons for IT firms to focus initially on the domestic market to develop experience and capabilities before venturing into international markets. Producing for the domestic market allows companies to develop close ties with users who can provide valuable input into the product development process. A networked economy using computer technology in various sectors will bring end users and developers of software closer leading to the germination of new product ideas[37]. It will also improve IT firms' customer-focus and enhance their marketing skills, areas in which Indian IT firms seem to be deficient. Indeed, in a discussion paper[38] on the Indian IT Industry, the World Bank notes that "there is a low perception of Indian software skills in OECD markets, particularly in larger scale) project management, the ability to complete projects on time, and the responsiveness to changes to specifications." One way Tamil Nadu software houses can improve quality, productivity, marketing and product development is by tapping into the domestic market. Let us reiterate that this focus on domestic market need not have to be realized at the expense of a firm's export orientation. Several software development houses in China, in addition to carrying out contract programming for the account of foreign firms, also design products specifically targeted for the huge Chinese IT market.

India's Ninth Five Year Plan has projected[39] that by the year 2001-2002, IT revenues in Tamil Nadu will be around Rs.130 billion (US$3.25 billion), with US$1.25 billion in hardware and US$2 billion in software. By maintaining its current export growth rate alone, the local IT industry seems most likely to meet this target. We believe however that, by carefully exploiting domestic market opportunities both in Tamil Nadu and India, the state IT

[37] *Bajpai and Shastri (1998), "Software Industry in India : A Case Study," HIID Discussion Paper*

[38] *World Bank (1995), "Exploiting IT for Development - A Case Study of India," World Bank Discussion Paper*

[49] *Government of Tamil Nadu, Information Technology Policy, 1997*

industry could not only easily surpass the US$3.25 billion mark, but eventually become the engine of growth of the Indian IT industry. In this section, we highlight a wide range of business opportunities that exist for Tamil Nadu IT firms in the educational, citizen, corporate, small scale, and Government sectors. Besides helping the local IT industry tap into these opportunities, the Tamil Nadu Government could also act as a role model and catalyst to raise IT awareness in the society and encourage the adoption of IT in all segments of the state economy.

**Opportunities within Tamil Nadu**

Today, there is an 80 million-strong Tamil speaking population worldwide and growing. S. Thondaman, Sri Lanka's Minister of Livestock Development and Estate Infrastructure, estimates that in three decades the global Tamil population would reach 100 million[40]. That's the combined size of the populations of the United Kingdom and Canada today ! Such a large market provides local IT firms the major advantage of economies of scale. Once the proper policy mechanisms to raise IT awareness are in place, the Tamil Nadu IT industry can expect to face a surging demand for IT products and services.

The Tamil Nadu IT industry is endowed today with two key technological enablers which, if properly harnessed through concerted efforts with the state Government: can help significantly accelerate IT diffusion in the state, and in the process create unlimited business opportunities. These enablers are a standardized Tamil font set and the Internet. Therefore all Government initiatives that aim to spur local IT demand need be driven by two imperatives: "Think Tamil," and "Think E-commerce."

"THINK TAMIL"

[40] *IndiaLine.net.Columns, February 22, 1999*

Today, most packaged software as well as content on the World Wide Web exists predominantly in English. This has been a major obstacle for spreading the IT revolution around the world. In France, for instance, the Internet penetration has been low compared to other European nations due to the prevalent use of French in everyday life. However, studies have shown that in countries where English is not the primary language, the success of raising IT awareness (and market penetration) significantly depends on the availability of software and media content in local language(s)[41]. One reason why Microsoft's Internet browser became so popular in Thailand is because, unlike its rival Netscape's browser, it is localized in Thai language. Many developing countries face the complex task of developing and promoting a standard coding for use of their local language(s) in IT. Even China is today griping with the problem of finding a uniform standard for the Chinese font. However, the Tamil Nadu Government has successfully developed an encoding standard for Tamil language. Now that a standard Tamil coding is available, the Government could encourage local IT firms to develop software in Tamil and produce online content in Tamil as well. To accelerate this process, a link needs to be established with overseas Tamil scholars, like U.C. Berkeley's George Hart[42], who have already made strides in using IT to promote the Tamil language.

## "THINK E-COMMERCE AND THE INTERNET"

With a US$3.2 trillion market potential (Forrester), Electronic Commerce is poised to become the engine of growth in the next century. Several Governments worldwide have woken up to this reality. Early this year, British Prime Minister Tony Blair asked Suma Chakrabarti, Director of his Performance and innovation Unit (PIU), to set-up a project team on e-commerce. In September 1999, this advisory group is expected to come up with a roadmap

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[41] *Economist Intelligence Unit, "e-business...is Europe ready?", 1998*

[42] *Tamil Chair at Berkeley (http://tamil.berkeley.edu)*

"to make the UK the best place for e-commerce by 2002[43]. According to IDC estimates, E-commerce revenues in India in 1999 will amount to about US$30 million, and then grow to US$51 million in year 2000 and US$575 million in 2002. The impact of e-commerce on the economy however extends far beyond the monetary value of e-commerce activity. Businesses use e-commerce to develop competitive advantages by providing more useful information, expanding choices, developing new services, streamlining purchasing processes, and lowering costs. The Internet also imposes price discipline as customers have access to price and product information from many sources. As e-commerce spreads, the employment effects will be felt throughout the economy. Workers that provide shipping and delivery services, online content, desktop publishing, etc. will be in high demand (U.S. DOG, 1999). Given all the benefits brought by e-commerce to both the economy and the society, it is imperative for the Tamil Nadu Government to aggressively promote e-commerce within the state[44].

We need to keep in mind the two aforementioned imperatives. In examining IT opportunities within each segment of the society and economy, we will therefore pay particular attention to initiatives that could help promote the use of Tamil as well as harness the Internet and e-commerce technologies.

**Applications of IT in the Government**

Governments in countries that are leading the IT revolution around the world also happen to be big consumers of IT products and services themselves. Their generous public IT expenditure, which has kept increasing over the years, is a spur for their domestic

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[43] *Comments collected from Mr. Chakrabarti's PIU Central Team at the British Cabinet Office.*

[44] *R. Gupta, Secretary, DoE, "E-business would cut through the functioning of Governments, corporates and individuals and it is important to recognize the opportunity offered by it for global competitiveness".*

IT industry, providing it with a regular revenue stream. In 1999 alone, the U.S. federal Government, for instance, is expected to spend US$33 billion on IT. More importantly, this large IT expenditure aims to make the Government more efficient and usher in the era of electronic governance, popularly known as e-governance, in which all Government database services are made available to the public and citizens can interact online with Government departments[45]. The result is a more responsive state bureaucracy.

One country that has succeeded in introducing electronic governance in a big way is Singapore. In the 1980s, well before the concept of e-governance becomes popular, the Singapore Government initiated the Civil Service Computerisation Program (CSCP) as a mean to increase productivity in all Government agencies and improve the Government/citizen interface. By 1996, it had invested a total of almost S$700 million in various CSCP projects[46]. The program has been a big success. Today, it takes only 15 seconds for frequent travelers carrying a smart card to get immigration clearance at the Singapore Airport and less than 10 hours for a ship to unload its cargo at the heavily automated Singapore Port. The CSCP has been widely credited for creating a vibrant IT industry in Singapore, and transforming the island-nation into a business hub for IT MNCs Sisodia(1992). The intelligent use of IT by the Government is also quoted in the Global Competitiveness Report, which has in recent years placed Singapore among the top nations in the world that have effectively exploited IT WEF (1998).

We encourage the Tamil Nadu Government to embark on a similar comprehensive Government computerization program that aims to provide a wide range of services to its citizens. As a step towards transparency and e-governance, the Government has already

[45] *U.S. Commerce Secretary W. Daley recently announced his plan to make his Department paperless by 2002*

[46] *National Computer Board, IT Policies in the Asia-Pacific (www.ncb.gov.sg)*

set up Web sites that provide citizens' information services (GISTAMIL NADUIC) and general information of public interest (e.g., Chennai Traffic Police). However, these Web sites offer only 'static' information. For instance, application forms provided on GISTAMIL NADUIC's Web sites can not yet be filled up online and submitted online. We urge therefore to improve Government Web sites by incorporating a two-way communication mechanism that will allow state departments to 'hear the voice of their citizens.' In addition to providing an electronic interface to its citizens, the state Government could also computerize all inter-departmental communication and introduce e-commerce applications like Electronic Procurement System that will make Government purchasing more competitive and transparent. Such Government computerization projects do have a monetary return : the Singapore Government has obtained a return of S$2.71 for every dollar spent on IT in the CSCP[47].

Based on the experience of other developing countries that have attempted with Government computerization programs and e-governance schemes, a few caveats should however be noted :

1. *Lack of involvement from all concerned parties :* a'bottom-up' approach is necessary when it comes to designing and implementing a comprehensive, large-scale computerization program in the public sector. All constituencies need to be consulted and represented in the implementation committee. Should that not be the case, departments officials would resent their being 'left out of the loop' and would reject any IT solution proposed by the Government. More so since many already fear that e-governance might undermine their influence Bajpai and Dokeniya(1999). The Tamil Nadu Government therefore may want to take time to achieve consensus among all departments on the IT solution to be deployed before attempting to implement it.

[47] *National Computer Board (1992), A Vision of an Intelligent Island: IT2000 Report, Singapore : NCB*

★ *Lack of private sector involvement :* as we mentioned earlier, computerization programs in the civil sector are supposed to spur domestic IT market by offering local players a chance to manage large-scale IT projects. One way to get the private sector involved is to invite domestic - or for that matter, international- IT firms to join Government IT projects in their early stage of conceptualization. This collabouration would result in IT solutions that realistically can be implemented. Also, the implementation part may be outsourced as much as possible to the private sector. The Government agency responsible for IT formulation or the design of Government IT solutions may wish to avoid getting involved in their implementation aspects. Tamil Nadu could follow the example set earlier by Singapore. In 1996, it announced that the National Computer Board (NCB) would no longer carry out the systems building and maintenance functions of the CSCP but outsource these to the industry. The move was supposed to encourage the private sector to come forward with innovative ideas and ensure that the civil service stays as a leading user of IT[48].

3. *Lack of training :* ambitious targets like "Two PCs for every five department officials" are meaningless if these 'department officials' are not trained to operate their computers. It is therefore vital for the Tamil Nadu Government to allocate sufficient budget to train its civil servants in the use of IT.

**Applications of IT in the Tamil Society**

The Confederation of Indian Industry (CII) Tamil Nadu has already produced an "IT Vision" document that lists major application areas for IT in the society[49]. We will therefore highlight here only some of the IT applications that could yield important societal benefits :

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[48] *National Computer Board, UseIT Newsletter, 1995*

[49] *According to S. Mahalingam, EVP at TCS and head of CII-TAMIL NADU's IT Panel, this Vision document highlights the positive social transformations that could be realized through the intelligence use of IT and the Internet.*

★ CREATION OF TAMIL LANGUAGE 'PORTALS'. This is a good way to start 'hosting' Web sites in Tamil Nadu. 'Portals are Web sites that act as a gateway, or starting site, for users when they get connected to the Web or that users tend to visit as an anchor site. Most Indian sites do not draw sufficient proportions of traffic from within the country. The Tamil Nadu Government has already created a "Tamil Software Development Fund" to encourage the rapid growth of Tamil software and Tamil content on the Web. So setting up 'Portals' in Tamil language and hosting them in Tamil Nadu seems to be the logical next step to bring online the richness of the millennia-old Tamil culture.

★ IT AS AN EQUALIZER. In order to avoid a 'digital divide' within the society, the Tamil Nadu Government can encourage the development of IT applications that benefits minorities and poor people in the state. For instance, it can help hill tribal people in Tamil Nadu sell their handicraft products through the Internet.

★ TELE-EDUCATION. In China, half the 92,000 students who graduate with degrees in engineering and technology each year are taught through distance learning provided by traditional universities World Bank (1999). Similarly, the Tamil Nadu Government can support life-long learning by setting up virtual universities to allow working professionals and housewives to further their education at their own pace

**Applications of IT in Various Tamil Nadu Industries**

The economic reforms initiated in 1991 have thrown the doors open to foreign investors and forced domestic companies to compete with MNCs in many industries. While some local companies have 'dodged' the bullet and reinvented themselves to better confront international competition, many others are worried that they would soon be 'swamped' away by foreign rivals. In this context, IT firms

in Tamil Nadu can easily convince local industrial houses how IT can be used as a weapon which, by increasing their operational efficiency, will enable them to better compete with MNCs. As mentioned earlier, IT spending has generally remained low in India when compared to the rest of Asia. Many Indian CEOs still do not consider IT investments as a top priority. This attitude needs to change: concerted efforts by the Tamil Nadu Government, business community in the state, and local IT firms could help raise awareness among local businesses of the strategic value of IT.

Here are some industries in which demand for IT products and services can potentially be high:

★ *Agriculture :* Farmers could be encouraged to trade their commodities over the Internet. Or, even better, Government cooperatives can setup online auctions to sell off their surplus.

★ *Construction :* Tamil Nadu is fast emerging as the single largest destination within India for infrastructure investments. Consequently, there is a high potential demand for engineering software, e.g., Computer Aided Design (CAD) system. In India, the CAD market today is entirely dominated by U. S. products. In China however, the National Engineering Research Center (NERC) has developed a CAD system for building design that is today used by more than 80% of China's firms. It has become the national standard design software because its cost is much lower construction engineering service fees, it is designed for building materials commonly used in China, and it has integrated the national building codes in the design options. This software system is considered to be a world-class product by the local construction industry[50]. Similarly, the Tamil Nadu Government can fund TANITEC to develop indigenous CAD software.

[50] *US Department of Commerce, Visit to China by Asst. Secretary Graham Mitchell, Travel Report, July 1997*

★ *Handicraft exporters :* Today, Tamil Nadu's share in India's output for leather products is 70%. The Indian Government has set an ambitious target of US$4 billion for leather product related exports by the year 2000, This translates into exports worth nearly US$2.2 billion from Tamil Nadu[51]. One way Tamil Nadu can sustain this lead is by setting up a Web site for handicraft products, targeted at both domestic and export markets. The same applies to ready-made garments since 21% country exports in this industry come from Tamil Nadu.

★ *Small-scale industries :* Internet initiatives have already been launched for the small-scale sector. For instance, the Madurai District Tiny and Small Scale Industries Association (MADITSSIA) is one of the first small-scale industries associations in the country to go online. But this Web site doesn't provide for any E-Commerce transactions. Local IT firms can help SMEs go global by incorporating support for online purchases via their Web sites.

Whichever industry it is, be it construction, healthcare or agriculture, it is clear that electronic commerce and the Internet are key to help maintain a sustained competitive advantage. The World Economic Forum, commenting on the findings of the 1999 Global Competitiveness Report, notes that "it seems readily evident that any economy - and certainly any company - that intends to remain a vigorous competitor in the next century will need to embrace the potential of e-commerce.[52]" It is therefore crucial that the Tamil Nadu Government encourages local businesses to use the Internet to sell to their customers and communicate with their partners. It is equally important for local IT firms to develop the skills needed to design e-commerce solutions. In this context, it is encouraging to see many Tamil Nadu IT firms joining rapidly the e-commerce bandwagon. For instance, Chennai-base Satyam

[51] *Focus Tamil Nadu Website (www.focustamilnadu.com)*

[52] *World Link Magazine, World Economic Forum, July/August 1999*

Infoway, a fast-growing ISP, is involved in EDI projects for the Indian automobile industry, and has a tie-up with U.S.-based company Sterling Commerce for an e-commerce node called Commerce Exchange, the second such node for Sterling outside the U.S[53].

**Untapped Opportunities within India**

Bhandari and Everett (1998) note that India has some significant advantages over most other emerging economies. Among emerging markets, only India, China, Russia, Brazil offer continental scale economies. Economies of scale are indeed important: if the U.S. managed to grow and become the largest economy in the world, it was by applying on a continental scale the techniques of the industrial revolution developed in Europe. Similarly, a country the size of India with 1 billion people using the same currency offers to almost any business the potential for maximum economies of scale, without going outside the country. With a domestic market the size of the U.S. or larger could eventually develop in India, it can't develop in most other emerging market economies. To achieve such economies of scale, smaller IT producing countries like Israel and Ireland have no choice but to turn to export markets, where they may encounter trade barriers and greater competition. That requirement adds an extra layer of complexity and uncertainy to their long-term growth potential, a layer that doesn't exist in India[54].

However some may argue that despite having a 1 billion population, India's domestic IT market remains underdeveloped. It depends on how one views it. Today in India, there are about 24 million cable users. If tomorrow all these users were provided an Internet access via cable, we would overnight end up with an Internet market similar in size with that of France, Germany and U.K combined[55]! We must

[53] *"Tamil Nadu Meets the Internet Challenge," India/Line Editorial, September 1998*

[54] *SiliconIndia," Economic Growth in India : We Shall Overcome," March 1998*

[55] *Nua Internet Surveys (www.nua.ie)*

acknowledge that, while the Indian domestic IT market has been growing at over 40% over the past 5 years, most of this growth is attributed to foreign IT goods and services, which are now easier to import due to reduced tariffs. In other words, Indian IT firms are losing their grip of their own market! There is therefore an urgept need for local IT firms to start exploring opportunities in the domestic market as well. Tamil Nadu currently accounts for only 7% of the total revenue from hardware and software in the country. We believe that, by strategically leveraging its competitive advantages, the state IT industry can rapidly increase its share of the national IT market.

Here are some opportunities that exist for the Tamil Nadu IT firms at the national level :

PRIVATIZATION OF INDIAN PSUs: Once these PSUs are privatized, they will need to increase their operational efficiency in order to compete globally. As we know, IT is the best enabler for business process reengineering. Tamil Nadu IT firms should therefore be ready to satisfy the huge appetite for IT products and services that the 'NavaraTamil Naduas' will be developing in the coming years. In Brazil, following the privatization program in the 90s, former state-owned giant enterprises that invested little in IT modernization ended up with new private owners, who are now scrambling to upgrade their IT systems. As a result, the Brazilian IT market is literally exploding, with huge demand for telecommunications and IT consulting services. For instance, in 1998, the Brazilian Government auctioned off the entire telecommunications sector for almost US$20 billion[56]. Unfortunately, most of these computerization efforts in Brazil are led by MNCs since the local players never had the opportunity to develop their skills in the domestic IT market. By making the local IT industry more competitive, the Tamil Nadu Government will help them better exploit the immense IT opportunities resulting from the privatization of Indian PSUs as and when it happens.

SOFTWARE LOCALIZATION : Following Tamil Nadu's leadership in adopting a standard coding for Tamil script, many other

[56] *Hinchberger, Bill, "Shaking Brazil's IT Booty," WebPaulo Advisor, February 26, 1999*

Indian states are scrambling to develop a standard for their own local languages. As we mentioned earlier, localized software and media content is key for spurring local IT demand, particularly in the rural areas. Business users on the Web are three times more likely to purchase when addressed in their native language (Forrester)[57]. In this context, the *Multilingual User Interface Design Software* currently being developed by IIT-Madras can be a boon for software developers nationwide. Once completed, this software could handle multilingual user interfaces on computers. Its usefulness for the Indian society is so attractive that in 1998 it was nominated for the prestigious Global Bangemann Challenge Award, a European Union-sponsored award program that recognizes innovative uses of IT for the benefit of the society. IIT-Madras is now working on a phonetic engine for Indian languages. The Tamil Nadu Government could explore the commercial potential of such technologies (particularly in the translation software area) and help it license nationwide.

ONLINE EDUCATION AND INTERNET ADVERTISING : The fact that Internet advertising revenues worldwide more than doubled between 1997 and 1998 suggests the growing importance that businesses are placing on this new way of reaching customers. According to Goldman Sachs Asia (1999), Internet advertising in Asia is expected to become a $1.5 billion industry by 2001, with India and China generating a substantial part of the demand. Given Tamil Nadu IT firms' talent for multimedia authoring (Chennai-based Pentafour designs animation content for Hollywood movies), it must be easy for them to leverage those same skills to develop online advertising content. Another area for Tamil Nadu IT firms to tap into is the Internet training and online education market, which is another multi-billion dollar market. Already named as the 'academic capital' of India, Tamil Nadu could gain a similar title in the online world as well.

## Enhancing Supply-Side Capabilities

In the first part of this section, we focused on how the Tamil Nadu Government can boost local demand for IT products and

[57] *Forrester Research, as reported in The Internet Economy Indicators (www.internetindicators.com)*

services, thus creating a vibrant domestic market that constitutes a spur for the state IT industry. In this second section however, we will highlight policy mechanisms to strengthen the Tamil Nadu software industry capabilities and export networks. Taken together, these supply-side and demand-side enhancement policies constitute a comprehensive IT-led growth strategy that will help lift the international competitiveness of the local IT industry significantly.

In order to strengthen the supply capabilities of the IT industry, the Tamil Nadu Government may need to adopt a four-pronged strategy to assist local IT firms. It could :

★ Facilitate their access to capital
★ Identify new export markets for their products and services
★ Enhance their global marketing and networking capabilities
★ Help them climb up the innovation ladder

While describing below details of each of these initiatives, we will also attempt to correct some misconceptions associated with some of them :

★ Myth #1: *The only way for an Indian IT firm to raise money is firm abroad.* Actually investment money is available locally if you look at the right place. After all, many of the industrial investments made in the country in the post-1991 period were by local investors. While venture capital from abroad and getting listed in the U.S. do bring investment, it is equally important to tap into *domestic* sources of investment.

★ Myth #2: *Exports marketsfor IT exist only in developed economies like the US and Europe.* Today the fastest growing IT market is not the U.S. but China, which next year is poised to become the largest IT market in Asia (excluding Japan). Brazil's IT industry today is worth $25 billion, which is many times larger than India's.

★ Myth #3: *Letting foreign ITplayers in will automatically translate into boosting local supply capabilities:* convincing a foreign IT firm to bring in capital is one thing, persuading them to transfer knowledge is another. Technology transfer is not always automatic. With Government help however, local IT

firms can learn how to tap global knowledge and climb up the innovation ladder.

We will now study how each of the aforementioned initiatives could be implemented.

**Facilitate access to local and global capital**

In the U. S., while venture capitalists remain some of the biggest investors in the local IT industry, they are today joined by financial institutions and major corporations which, attracted by the recent boom in tech stocks, want to profit from the knowledge revolution. We mentioned earlier about the 'servitization' of the world economy. That phenomenon is partly driven by the massive investments being made by non-service industries in the IT sector. General Electric today is swooping up IT firms all around the world. According to its Chairman, Jack Welch, any major corporation that hasn't yet diversified or invested into the Internet business will not survive in the next century. Which could explain why Bechtel, the engineering giant, recently cut a $1 billion deal with Webvan, a 1-year old Internet startup that sells groceries online, to build its e-commerce distribution network nationwide. This newly found interest in Internet investments among big U.S. corporations is a boon for IT entrepreneurs in the U. S.

Diversification into IT is not a new phenomenon. Thailand's CP Group, whose core business is agribusiness, has successfully branched out into telecommunications. Even in India, Wipro's Premji has shown that it's possible to make transition from soaps-to-software and become the richest man in India[58]. However, barring some successful exceptions like the Tata Group, the majority of Indian conglomerates have displayed a strange aversion for diversifying into the IT or the new media business. One explanation could be that assets in IT firms are mostly intangible and therefore difficult to measure in terms of ROA. This could explain why when Infosys, one of the most successful Indian IT firms, went public in India in 1993, almost all its investors were foreigners[59]. In Tamil Nadu, large family businesses like the

[58] *Far Eastern Economic Review, "Who's that Man?" August 19, 1999*

[59] *Fortune, "The Soul of a New Machine," INDIA The Next 50 Years, September 8, 1997*

multi-billion Murugappa Group, focus on business lines centered around agribusiness or manufacturing, but rarely around IT-related products or services.

Given the on-going IT-led 'servitization' of the world economy, it is imperative for the Tamil Nadu Government to convince local conglomerates to invest into IT. Rather than building from scratch IT subsidiaries, which is a risky and expensive option, these large businesses could simply invest in promising local IT firms. They can set up an investment arm, like General Electric has done, to channel venture capital into IT startups. While these investments don't need to be substantial, their payoff however could be really big. When Dixons, a large U.K. consumer electronics retailer, saw an opportunity in the Internet Service Provider market, it started its own ISP business using an innovative business model : provide Internet service for free (subscribers pay only the cost of a local phone call to get on-line). Five months later, Dixons had taken the lead in British consumer Internet subscriptions.

Apart from helping local IT firms tap into the cash reserves of domestic conglomerates, the Tamil Nadu Government could also help them raise capital through Venture Capital (VC) sources that exist both domestically and internationally. Unfortunately, unlike in Israel that has a vibrant US$3 billion VC industry, in India the VC concept is still new and not widespread. VC currently represents less than 1% of the sources of funding for Indian software companies compared with over 30% in the U.S.[60] Indian venture capital companies are new and lack the industry and technical knowledge required to properly assess software markets and products on the merits of professional software firms. There is also an issue at the receiving end: local entrepreneurs seem to think that VCs give out grants. According to Mr. Prakash, Tamil Nadu IT Secretary, "there is a general tendency to confuse such funds with outright grants." The Tamil Nadu Government needs to help local startups realize that VC funding has to be based on a sound business model - a high risk one perhaps. Having highlighted some potential domestic sources of investment, let us

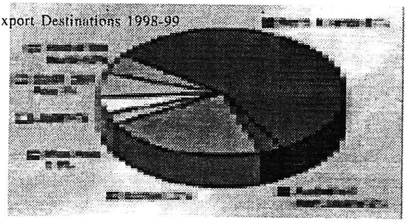
[60] *World Bank (1995), "Exploiting IT for Development - A Case Study of India," World Bank Discussion paper*

turn our attention to foreign investments. There any many ways the Tamil Nadu Government can help here. It can provide assistance.to local IT firms to get listed in the U.S. stock market. Today, 120 Israeli firms and 13 Irish firms are, trading on Wall Street (mostly on Nasdaq[61]) compared to merely one from India (Infosys). The Government can also convince international venture capitalists to invest in the local IT industry[62]. But most importantly, we believe the Government needs to aggressively promote investment opportunities in the local IT industry to every single MNC that is already present or planning to enter Tamil Nadu. For instance, if Bechtel evinces interest in developing public infrastructure in Tamil Nadu, the state Government may try to convince Bechtel how the firm also stands to gain by 'remote-sourcing' its engineering design services to Tamil Nadu IT firms and by investing in promising local e-commerce startups.

**Help local ITfirms access untapped export markets (in Asia and developing world)**

Indian IT firms consider Europe and the U. S. as major destinations for their software exports. However, there are numerous untapped market opportunities in other parts of the world.

India's Software Export Destinations 1998-99



*Source:* NASSCOM, 1999

Israel wants to become a regional IT gateway to the 400 million people located in the Middle East. Why can't Tamil Nadu become a regional gateway to Asia, home to half the humanity?

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[61] *Forbes ASAP, "Startups Abroad : The Irish-Israeli Technology Tango," June 14, 1999*

[62] *Gray Cell, a Bangalore-based Internet Startup, made a history recently by raising $1.7 million from Silicon Valley based venture capitalists. This is probably the first of its kind of venture funding.*

**Brazil**

*Population* : 170m

*Internet users* : 20m (in 2003)

*IT Market* : $25 billion

*IT Market Growth* : >25%

*Other* :

40%L. American IT market

88%L. American online sales

<1% of India's total software exports globally

**Tamil Nadu**

**India**

**Asia**

**Developing World**

**Europe & U.S.**

**China**

*Population* : 1.2 billion

*Internet users* : 30 million (in 2003)

*IT Market* : $15 billion (in 2000)

*IT Market Growth* : 28%

*Other* :

Largest Asian IT market by 2000

<0.5% of India's total software exports globally

## Spur Innovation and Help Climb Value Chain

IT companies in India are increasingly becoming aware that to be able to compete in the global market they have to move up the value chain. With increasing competition from countries like China, Philippines and Russia, Indian software firms realize that they can no more compete on cost alone. They are conscious about the imperative to shift their main activities from low-level offshore programming to higher margin businesses like packaged software development and knowledge-based IT services. Unfortunately, most lack knowledge about how to upgrade their operations and climb up the innovation ladder rapidly.

The Tamil Nadu Government therefore needs to step in and help spur innovation in the state IT industry. Here, Ireland offers a good example of efficient Government intervention in the IT sector. Back in the 80s, Ireland was in a similar situation to India. It's local IT industry was underdeveloped. The Irish Government commissioned Ira Magaziner -later to become technology advisor the U.S. President Clinton-to examine the country's competitiveness in the international market place. Magaziner came up with the "Telesis Report," which said Ireland was investing too little in indigenous businesses. "The Irish Government's industrial policy needed to change," noted Magaziner. He recommended more Government support to the local industry, particularly the hi-tech.

The Irish Government did heed Magaziner's advice and doesn't regret it: today, Ireland is the second largest software exporter in the world, after the U.S. "I am very impressed with the country's willingness to enter into the information age," acknowledges Magaziner[63].

Like Ireland, Tamil Nadu can also move up the IT value chain and become an innovative leader in the global IT industry. Tamil Nadu already ranks second in India, in terms of value-addition in industry. It can move up to the top slot by spurring innovation in the local IT industry. Prof. Abdul Kalam, who hails from Tamil Nadu, has already shown to India how, by harnessing local talent and indigenous technology, it can enter into the elite club (and lucrative market) of satellite launching business. In a similar manner, Tamil Nadu now needs to foray into the high-end segment of the IT value chain. The state Government can achieve this by helping local IT firms gain access to foreign technology and exposure to international best practices, promoting market-driven domestic R&D, facilitating technology transfer between state universities and local IT industry and finally by fostering an entrepreneurial milieu that spurs innovation.

### Tap Global Knowledge

*Work with foreign investors that are leaders in innovation, spurring domestic producers to try to match best practice and tap potential knowledge spillovers*[64]. While some IT MNCs are setting up development centers in India, almost none are willing to open a full-fledged R&D center in India (with the notable exception of IBM in New Delhi). While R&D centers are not likely to employ as many people as in the case of software development, its spillover effects are much more consequential. Because of R&D's high value, each time an IT MNC chooses another country over India for a

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[63] *Wired Digital Inc, "Ireland, the Silicon Isle," Wired News, October 29, 1998*

[64] *For Barlett & Ghoshal (1998) and C.K. Prahalad (1999), "tapping into international markets means more than accessing new customers. It also means accessing new talent, knowledge, information and experience (wherever they exist)." For them, the "next phase" of globalization involves creating and leveraging multiple sources of innovation.*

new R&D center, India loses the opportunity to gain access to the cutting-edge technologies that could have resulted from these R&D activities. China however has well understood this: its Government has successfully convinced many IT majors like Intel, Microsoft, HP to set-up full-fledged R&D centers in Beijing. Similarly, the Tamil Nadu Government could leverage the state's reputation of an 'intellectual powerhouse' to convince IT MNCs to set-up research centers in Chennai.

Moreover, the Government has to look for sources of IT innovation everywhere. For instance, the CEO of Ford Motors, which is one the largest foreign investors in Tamil Nadu, has declared that he wants to get the highest return possible from every single dollar that the firm spends on research and engineering[65]. The Government could convince Ford top management that outsourcing their IT-intensive R&D and Engineenng (RD&E) to Tamil Nadu would be a good way to save costs. To ensure that FDIs in the IT sector keep flowing, the Tamil Nadu Government may want to establish a representative office in the US. Israel has set up the BiNational Industrial R&D Foundation (BIRD), which encourages joint ventures between Israeli and American high tech companies. BIRD was so successful that it inspired Ireland to create its own version: RADIAN-Research and Development Ireland America North. Even the Indian State of Karnataka has opened an office in Silicon Valley. It is therefore imperative for the Tamil Nadu Government to have a representation in the U. S.

*Get access to new proprietary technical knowledge through technology licensing.* The Government could try to promote its domestic market among foreign IT majors as a test bed for pilot projects involving their cutting-edge hardware, software and telecom technologies. Singapore for instance has invited global telecom giants to use its on-going Singapore-ONE[66] project as a

[65] *The Economist, "The Revolution at Ford", August 7, 1999*

[66] *Singapore ONE is a national initiative to deliver a new level of interactive, multimedia applications and services to homes, businesses and schools throughout Singapore (www.s-one.net.sg)*

vehicle to 'test-drive' some of their most recent technologies and services. Malaysia is pursuing a similar technology transfer strategy with its Multimedia Super Corridor (MSG) project. Such proactive initiatives could bring far-reaching benefits to the local economy. For example, Hewlett-Packard 'test-drived' the Chinese market to introduce a cheap low-end server: the insight it gained through the development process eventually convinced HP that this product could be successfully sold around the globe. The product now is manufactured in China and exported worldwide. In order to facilitate technology licensing, the Tamil Nadu Government could create domestic information centers, where local firms can obtain information on foreign technology. Such a move will reduce local IT firms' disadvantages in licensing negotiations.

*Facilitate acquisition of lTfirms abroad.* IT firms in Tamil Nadu can take over companies abroad which have a promising software product portfolio but suffer from ineffective management and inadequate resources. Several Indian IT players like NIIT and Infosys are already in the process of acquiring US-based software companies. NASSCOM has recently pointed out that "the future strategy for the Indian software industry would (increasingly) involve more acquisitions of overseas companies". In anticipation of more overseas acquisitions by local IT firms as they climb up the value chain, the Tamil Nadu Government could convince the central Government to make such acquisitions easier. Actually, the state Government itself can participate in, and benefit from, this acquisition spree, by setting up an investment arm that buys into innovative startups in Silicon Valley or Israel. It can leapfrog entire innovation stages by first investing into innovative Silicon Valley startups and later transferring home their cutting-edge technology. The Governments of Singapore and Taiwan are already aggressively investing in Silicon Valley startups.

*Attract back home talented Tamil ITprofessionals who have studied or worked abroad.* The Tamil Nadu Government may initiate a 'Reverse Brain Drain' (RBD) program to lure back home the talented Non-Resident Indians (NRIs) of Tamil origin who have succeeded in the global IT industry. Such a program would

exploit the potential synergies between NRIs knowledgeable about the global software market, and the local IT firms. This program however has to be flexible enough not to ask these Tamil expatriates to return permanently to Tamil Nadu (although that couldn't be excluded either). Rather, Tamil Nadu's RED program needs to encourage these expatriates who wish to contribute to their home state and to maintain a foothold in their adopted countries, which after all is where the actual sources of innovation; are located[67]. 'You can make your millions in the Valley or in New York and still be guiding projects or start business in India - as indeed many of us are doing" acknowledges Kanwal Rekhi, President of The IndUS Entrepreneurs (TiE)[68], the premiere Indian entrepreneurial organization in America. One way the Government can leverage Tamilians abroad as a steady source of innovation is by inviting them to Tamil Nadu for short-term purposes only.

Thailand has already in place such a R&D program that allows Thai professionals abroad to visit Bangkok once or more in a year to collabourate with local researchers or lead seminars on a short-term basis. Closer at home, several Indian states have come up with original ways to bring in NRIs as 'conveyors' of innovative knowledge. In the past three years, for instance, NRIs from Orissa have been organizing in Bhubaneswar the 'National Conference on IT. This conference provides an excellent avenue for these NRIs to learn more about IT development in Orissa from local faculty and policy makers, as well as update them on recent technological and business innovations in their adopted countries. Ireland has gone even further by setting up a special department to welcome back the Irish expatriates.

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[67] *Saxenian, AnnaLee (1999), "Silicon Valley's New Immigrant Entrepreneurs", PPIC. In this scholarly report, Saxenian explains that the "brain drain" may be giving way to an accelerating process of "brain circulation". She notes that the Indian and Chinese immigrants who have studied and worked in the United States, while maintaining their base in their adopted country, are playing a growing role in linking U.S. technology businesses to those in their countries of origin. This report is available online on PPIC Web site (www.ppic.org)*

[68] *TiE is the premier Indian entrepreneurial organization in America with 600 members (www.tie.org)*

## Create Knowledge at Home

Tamil Nadu has a long tradition of scientific and technological innovation. After all, two Nobel-Prize winning astrophysicists - CV Raman and S Chandrasekhar- had their roots in Tamil Nadu. The U.S. NASA recently launched into space a state-of-the-art telescope named after Chandrasekhar. Of late, IIT-Chennai Professor Jhunjhunwala made a breakthrough in Wireless Local Loop (WLL) technology that has the potential to significantly increase the telephone penetration rate in developing countries like India. By encouraging more market-driven IT research in local universities, facilitating the transfer of technology between academia and local IT firms, and harnessing the inherent entrepreneurial mindset of Tamil people, the Government could transform Tamil Nadu into a vibrant IT innovation hub.

The key source of technological innovation is R&D, and in particular academic research. The significance of educational institutions as innovation incubators can not therefore be undermined. In many developed countries, universities have played a key role in fostering innovation, generating jobs and enhancing national competitiveness. For instance, the Massachusetts Institute of Technology (MIT) has over the years spawned 4,000 companies, creating 1. 1 million jobs worldwide that generates annual sales of US$232 billion (Bank Boston). The value of innovation generated at Stanford is equally staggering: the total of Stanford's cumulative income from patent licenses alone is worth more than US$300 million, while the annual revenues of the companies born at the university total more than US$100 billion[69].

Aware of the key role that higher education and research play in the economic vitality of a nation, the Tamil Nadu Government has set up TANITEC as a unique center of excellence in education, research and application of IT. TANITEC's future looks very promising. We would like to offer some recommendations that could help further boost TANITEC's success:

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[69] *Fisher, Lawrence (1998), "Technology transfer at Stanford University", Strategy & Business*

**TANITEC's core focus needs to be on R&D.** Keeping TANITEC's main mission in mind, Tamil Nadu needs to encourage TANITEC Faculty to devote as much time as possible on research to come up with innovation technologies that can be leveraged by the local IT industry. That's what Stanford, the innovation incubator of Silicon Valley, has been doing successfully for decades. Today, Stanford continues to show the way, conducting cutting-edge R&D that will lead to solutions that meet the new challenges posed by the digital economy. We would now highlight two roles defined for TANITEC in its charter[70]

I. *"Computerize the operations of the State Government"* While the TANITEC Faculty might participate in these computerization projects as expert consultants, the implementation responsibility needs to be assumed by the IT Secretariat. In turn, the IT Department, while maintaining a supervisory role, may itself wish to delegate the operational aspects of IT projects to the private sector. Such a distribution of roles would have three major benefits. It will :

- ★ Enable the TANITEC faculty to focus on R&D.
- ★ Expedite Government computerization through increased private sector participation.
- ★ Provide an opportunity to local IT industry to gain valuable experience and expertise. For instance, the Singapore Government set up in 1986 an Information Technology Institute (ITI) to carry out applied R&D. Although ITI provided a readily available 'in-house' talent pool, the Singapore Government decided to let the private sector implement most parts of its ambitious Civil Service Computerisation Program[71]. Such a move not only provided a spur to the Singapore IT industry, but also allowed ITI to focus on its core competency (R&D).

II. *"Providing software testing certification and quality assurance certification"* While TANITEC is mandated to extend

[70] *ELCOT Website : http://www.elcot.com/tanitec.htm*

[71] *National Computer Board, UseIT Newsletter, 1995*

technology and services into industry, these certification activities could as well be handled by existing Government agencies like ETDC[72], a move that would help TANITEC allocate more resources to research and teaching.

**Learning to commercialize innovation.** Equally important to generating innovation is the focus on how to transform it into a commercial product. At Stanford, the emphasis is always kept on how to market the bounty of knowledge. To facilitate the marketing of its innovations, Stanford has set up a highly proactive Office of Technology Licensing (OTL) that identifies market opportunities for new technologies created at Stanford. As mentioned earlier, the total of Stanford's cumulative income from patent licenses is worth more than US$300 million. As TANITEC is slated to become a self-financing university in the future, income from its patent licenses will be key to its survival. It might therefore consider setting up a market-driven Office of Technology Licensing similar to that of Stanford. It can actually seek the services of Mr. Niels Reimers, the founder of Stanford-OTL, who today consults universities around the world on how to market intellectual property. Moreover, TANITEC can also leverage its proximity to an IT Park to attract IT startups that might want license its technology and use the Park as a launching pad. This strategy worked well for Stanford. For instance, Cisco Systems Inc.'s original products were built with computer networking technology invented at Stanford and used under license. Cisco also used Silicon Valley where Stanford is located as its launching pad. Today, Cisco is worth over US$200 billion. To this day, according to Stanford's James Gibbons, half of Silicon Valley's revenues come from Stanford-seeded companies.

**Cultivate strong relationship with industry.** A strong linkage with local (or foreign) IT firms will allow TANITEC to bring in several benefits: investment capital, consulting opportunities, additional adjunct faculty, a market-driven focus to its research, as well as internship and project opportunities for its students. In

[72] *The Electronics Test & Development Center (ETDC) is an independent IT test labouratory under the DoE*

Silicon Valley, the 'town-gown' relationship is so deep that, according to Stanford Provost John Hennessy, "the gap between research and what's in production has narrowed to almost nothing. " The benefits for the industry are evident: access to cutting-edge technology, a fertile ground for recruiting talented employees, etc. In this regard, TANITEC's requirement that all its students participate in industry projects is laudable. "In the knowledge economy, the most important form of technology transfer is in the minds of the graduate students," acknowledges Stanford's Niels Reimers. As far as attracting foreign investments is concerned, TANITEC can learn much from the Indian Institutes of Technology (IITs). IIT- Delhi has already forged a strategic R&D parTamil Naduership with IBM, which is has set-up a research lab on its campus. Closer at home, IIT-Chennai has convinced Intel Asia to sponsor its cutting-edge research program in 'speech recognition' technology.

One can point to TANITEC's youth to raise doubts about its ability to attract investments. However, such a concern does underestimate the industry's investment potential. In South Korea, after initially lagsging behind the three-decade old, Government-sponsored KAIST University, the industry-sponsored POSTECH, within just 12 years of existence, had caught up. Today, both KAIST and POSTECH are considered the very best academic institutions in Asia[73] in science and engineering. Generally, countries in which industry's contribution to national innovation is limited tend to rank lower in terms of global competitiveness. For instance, Taiwan, where the private/public R&D investment ratio is 4.1 ranks 4th in terms of global competitiveness whereas Thailand, where the same ratio is 1:4, ranks only 30th. As far as India in concerned, Bajpai and Sachs (1998) note that involvement of private sector in R&D is abysmally low.

**Set up and International Advisory Committee.** TANITEC may wish to setup an International Advisory Committee made up

[73] *According to Asiaweek's "Best Universities in Asia 1999", KAIST and POSTECH rank respectively as #1 and #2 Science & Technology Schools in Asia. IIT-Delhi and IIT-Chennai occupy respectively the 4 and #5 slots.*

of Faculty from top research institutions like Stanford, MIT and POSTECH, as well as CEOs of IT MNCs. The international perspective brought in by this committee will allow TANITEC to constantly monitor the international competitiveness of its teaching and research, and make its academic contribution more responsive to the evolving needs of the global markets.

### Fostering IT Entrepreneurship in Tamil Nadu

While Indians in general, and Tamils in particular[74], are well known for their entrepreneurial talent, no 'institutionalized' mechanisms are yet in place in the country to channel and nurture that talent. In the U. S. however, a vibrant venture capital industry and a 'hands-off' Government approach to business have helped create an environment highly conducive for entrepreneurial endeavours. Scarcity of capital remains a big impediment for IT entrepreneurship to take off in India. M. Nambiar, former ELCOT Chairman, complains that "banks in Tamil Nadu, and generally in India, are wary about financing IT entrepreneurs. Banks are looking for quick returns, 100% success and prefer investments in tangible assets. Unfortunately, an IT startup can't guarantee success or promise rapid profitability and tends to invest mostly in intangible assets like its employees[75]".

The Government needs therefore to step in and help foster an entrepreneurial milieu in Tamil Nadu to help spur indigenous innovation. As we suggested earlier, it could convince big industrial houses in the state to invest and provide 'seed' money to local IT startups. The Government could also sponsor, jointly with the local business community, informal forums where top executives of successful local or foreign IT firms can meet young entrepreneurs, offer them guidance and share insights based on their long experience with the IT industry. Hi-Tech giants like HP and SUN have successfully spun-off several startups now owned by former employees, who often become suppliers or clients of their former

[74] *Rediff on the Net reported that, within 10 days after the Tamil Nadu Government announced the coding standard for Tamil font, a local entrepreneur had produced a Tamil word processor based on the new international standard.*

[75] *Interview with M. Nambiar, former ELCOT-Chairman, August 1999.*

employer. Finally the Government may initiate a "Young IT Entrepreneur Award" Program to recognize young IT leaders who could become role models for their generation.

TANITEC's role in fostering entrepreneurship is critical. After all, without Stanford, a vibrant Silicon Valley ,would never have come about. Similarly, TANITEC needs to become a source of entrepreneurial talent. In this regard, MIT offers a good example. Cambridge, where MIT is located, is crowded with IT startups set up by MIT alumni. MIT has recently established the MIT Entrepreneurship Center to create and sustain local IT companies. MIT students who want to be involved in e-commerce startups (i.e., learn how to build and manage an eBusiness) are encouraged to tap into the 'incubator resources' available through the Center. Israel is another place where IT entrepreneurship is bustling with life. "Almost every day, another (army) graduate "sits down at his laptop and launches a company in Israe1,[76]" notes Ron Chaimovski, Israel's Economic Minister for North American Affairs. At Stanford, it is almost expected:that a successful faculty member will at some point start a company. Similarly, TANITEC could leverage its proximity to the IT Park to attract young entrepreneurs who wish to start a new company using latest technologies made available to them through TANITEC's Office of Techonology Licensing.

More importantly, the Tamil Nadu Government needs to network with overseas associations of Indian entrepreneurs, such as the SIPA (Silicon Valley Indian Professionals Association) and The Indus Entrepreneurs (TiE). TiE is a Silicon Valley based service group, set up in 1992, which has evolved into a vibrant organization with over 600 members with chapters in several U.S. cities. TiE is today headed by Kanwal Rekhi, an IIT alumnus described by Forbes Magazine as the "Guru of Silicon Valley." TiE has funded some highly successful companies like Hotmail, Exodus Corporations and Junglee and other start-ups in Silicon Valley. These TiE funded companies together have a market capitalization of many billion dollars today. K.B. Chandrasekhar, a graduate of

[76] *Forbes ASAP, "Startups Abroad : The Irish-Israeli Technology Tango," June 14, 1999*

Madras University, for instance, founded Exodus, in 1994. After five years of existence, Exodus is today worth US$7 billion and now ranks in Silicon Valley's top ten fastest-growing companies. TiE recently opened its first Chapter in India. The Tamil Nadu Government could convince TiE to set up a Chennai Chapter as well. Such a move will allow the Government to attract IT professionals of Tamil origin who have succeeded in Silicon Valley. They can be invited to give seminars, organize conferences, coach and/or finance the local entrepreneurial base.

**Enhancing Global Marketing Capabilities**

The Tamil Nadu administration has been very successful with its international promotional efforts to project Tamil Nadu as the best place to carry out car manufacturing. As a result, the state has emerged as the 'Detroit' of South-Asia. The Government now needs to display similar market savvy APPROACH to help Tamil Nadu emerge as the 'Cyber-Capital' of India. It needs to launch an international promotional campaign to establish the 'IT Brand Equity' of Tamil Nadu worldwide.

Tamil Nadu needs to build its marketing strategy on its comparative advantages. Some Indian states, despite scoring much lower than Tamil Nadu in various socio economic indicators, have managed to emerge as the top destination for IT investments in India. According to Fairbanks and Porter(1997) however, perception needs to be backed with substance. In order to wholly convince a foreign investor it is the best place for developing their core processes and products, a country (or sub-region) needs to demonstrate the availability of two critical resources: highly-talented labour force and specialized infrastructure. These are exactly the very two areas in which Tamil Nadu outshines all other Indian states[77]. It could therefore convert these comparative advantages into its competitive advantage in order to aggressively woo foreign IT MNCs to invest in Tamil Nadu.

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[77] *This point was well-made by S. Mahalingam who thinks the State's comparative advantage are 'real' (if investors come, they will see it by themselves); unlike some rival states where "reality doesn't match hype".*

To implement this marketing strategy, the Tamil Nadu IT Department could set up a marketing division to offer one-stop information services on local IT industry. This division could also set-up a Web site and take care of corporate communications. As part of the promotional activities, the IT Secretary needs to regularly lead IT delegations abroad to promote the local IT industry among MNCs and NRIs. Many successful Indian expatriates don't yet associate Tamil Nadu with IT. So far, only Bangalore and increasingly Hyderabad are associated with IT. Tamil Nadu remains synonymous with auto manufacturing. Consequently, there is an urgent need to change this perception among Indians abroad. Moreover, the IT Department could also open a representative office in Silicon Valley and enter into sister city agreements with other overseas info-tech industry clusters like Tel-Aviv, Israel's IT hotbed. Today, 300 Israeli companies operate permanent offices throughout the U.S. largely to aggressively market their technology and secure financing.

Furthermore, a'software monitoring' cell needs to be created[78] within the IT Department to constantly monitor the local IT Industry's global competitiveness. Ireland has setup a "Market Observatory" to benchmark on a continual basis Ireland's IT progress and state of readiness[79] compared with international standards. Finally, joint promotional activities with competitors can not be ruled out. For instance, the Chambers of Commerce of both Ireland and Israel in the U. S. jointly sponsor an annual conference on "Technology Investment & ParTamil Naduering Opportunities from Israel and Ireland." Similarly, Tamil Nadu could establish technology alliances with IT powerhouses like Israel to promote knowledge-intensive joint projects. In this regard, Tamil Nadu should follow the leadership of the U.S., where individual states are promoting links between their local IT industries and foreign countries with exceptional IT potential. The U.S. State of Pennsylvania for instance has already signed IT pacts with Israel and Ireland.

[78] *N.Bajpai and V. Shastri (1998) further propose that data generated in this cell should be available on a day to day basis to the highest officials and Government personnel dealing with software policy*

[79] *The new IDC/World Times Information Society Index ranks nations ever year based on their IT preparedness*

In addition to promoting the local IT industry, the Government also needs to start nurturing the image of Tamil Nadu as a sophisticated business hub. The purpose here is to highlight Tamil Nadu as an 'economic success' within India, rather thanjust another 'Indian IT success story'. For every article that Fortune 100 CEOs read on Bangalore's great IT success, there is another article like the one published last year in Newsweek. The latter noted that "Bangalore may be the jewel of India's high-tech crown, but there are still cows in the street and the phone lines break down every couple of hours.[80]" It is therefore imperative for the Tamil Nadu Government to equally emphasize its IT prowess as well as its socio-economic success. It also needs to highlight its strategic geographic location to promote itself as the " Gateway to India," an ideal place to establish connections (Kanter, 1995) with the rest of the country. This was the strategy that Singapore pursued in the 1980s to attract MNCs to set up their Asian Headquarters in the island-state. While in terms of infrastructure Tamil Nadu still lags behind Singapore (although it fares better than other Indian states), it has an indisputable cost advantage over Singapore: it is one of the cheapest places to live in India[81].

[80] *Newsweek, "The Hot New Tech Cities", November 9, 1998*

[81] *Guidance Bureau (TIDCO), "Welcome to Tamil Nadu," Online Presentation (www.focustamilnadu.com)*

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## *APPENDIX I : List of People Interviewed*

### Tamil Nadu Government

*Mr. D. Prakash, Secretary, IT Department*
*Mr. M. Nambiar, CMD, TANCEM (former CMD, ELCOT)*

### Tamil Nadu IT Industry

*Mr. S. Mahalingam, Executive Vice-President, Tata Consultancy Services (TCS)*

### U.S. IT industry

*Mr. S. Conover, President, CBay Systems Ltd*

### European Governments

*Mr. Suma Chakrabarti,*
*Director, Performance and Innovation Unit,*
*Cabinet Office, British Government*